UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Bureau of Commercial Fisheries

BRIEFING BOOKLET

PROGRAM REVIEW

Biological Laboratory, Woods Hole, Massachusetts

January 6 - 10, 1964

Review Committee:

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TABLE OF CONTENTS

	Page
Table of Contents	A-1
Schedule of Topics	A-3
Biological Research as Outlined in "Trident"	A-6
The Woods Hole Program as Outlined in the Regional Program (See Regional Program pp. 42-66	
Present Organization	B-1
Professional Staff	B-2
Budget Material	
Summary of 1964 financial programming	C-1
Analysis of recent budgets	C-2
Fiscal 1965. Narrative justification for increases	C-3
Fiscal 1965. Status of program statement, 21 August, 1963	C-4
Albatross IV financial program (indirect), 1964	C-6
Albatross IV annual budget for 1965	C-7
Technical and Administrative Services financial program (indirect), 1964	C-8
New England Landings Statistics	D-1
List of Species	D-5
Bibliography of Laboratory Papers	E-1
The Marine Biological Agreement	F-1
Libraries	F-2
University Rights by Deed of Land	G-1
Cruises of the Albatross IV in calendar 1963	H-1
Cruise Schedule for the Albatross IV for calendar 1964	H-2

	Page
Dedication of New Facilities, 1962	I-1
Commissioning the Albatross IV	I-2
Example of Annual forecast of abundance (December 1963 press release)	K-1
Maps of ICNAF Area	L-1
	L-2
Table of ICNAF Committees	L-3
Aquarium Program	M-1
Assessment of Effect of Foreign Fishing Program	N-1
Benthos Program	O-1
Cod Program	P-1
Experimental Studies Program	Q-1
Flounder Program	R-1
Groundfish Ecology Program	S-1
Haddock Program	T-1
Hake Program	U-1
Oceanography Program	V-1
The Woods Hole Oceanographic Institution Contract	V-4
	V-6
Review of Work on Contract	V-12
Plankton Program	W-1
Population Dynamics Program	X-1
Regional ADP Unit	X-6
Redfish Program	Y-1
Sea Scallop Program	Z-1
Industrial Trawl Fishery	AA-1

SUGGESTED SCHEDULE OF TOPICS

1. Welcoming Remarks. Consideration of time schedule.
2. History and development of the Laboratory Program. H. W. Graham.
3. The hydrography of our area of interest. Dean Bumpus and J. B. Colton.
4. Benthic studies program. R. L. Wigley and A. S. Merrill.
5. Sea scallop program. J. Arthur Posgay.
6. Groundfish ecology program. Raymond L. Fritz.
7. Cod program. Albert C. Jensen
8. Flounder program. Fred E. Lux
9. Haddock program. Marvin D. Grosslein.
10. Hake program. Bradford E. Brown.
11. Redfish program. George F. Kelly.
12. Population dynamics program. Richard C. Hennemuth.
13. Assessment of effect of foreign fishing program. Robert L. Edwards.
14. Experimental studies. Kenneth B. Cumming.
15. Resumé and recommendations for reorganization and further work. H. W. Graham.
16. Committee discussion.

Habitat Improvement

Just as man can spoil the habitat for fish and shellfish resources, he can also alter it in ways that would support larger and more productive resources. So wise use should also include habitat improvement.

Biological Research Problems

It is easy to state the principles governing wise utilization of living resources but extremely difficult to apply them. It is difficult because we do not have enough facts about most fishery resources or the environment in which they live to manage them intelligently. These facts are hard to get because most of them are hidden beneath the surface of the water and concern the subtle relations between aquatic animals and their environment.

Five broad categories of knowledge are needed, and the state of present knowledge ranges from good to poor approximately in the order listed:

1. Life histories--spawning times and places, ages and rates of growth, ages at first maturity, and migration patterns.

2. Population units--the extent of independent or degree of mixing between stocks of fish of the same kind.

3. Population renewal characteristics--effects of various rates of fishing on ability of stocks to replenish the supply.

4. Fluctuations due to natural causes--fluctuations in success of spawning and survival, and fluctuations in "availability" to the fisherman (vagaries of "fishing luck").

5. Environment requirements--what alterations in the environment increase or decrease its capacity to produce. This problem requires detailed study of lakes and oceans.

Life Histories

For most important kinds of fish and shellfish, the principal life history features are fairly well known or will be well known within a few years as a result of projects now underway. Knowledge in this field is fundamental to all other fields, and the Bureau's plan proposes to continue life history studies on an adequate scale to complete them promptly. Many important details remain unknown, however, for even the best known species, and continuous effort will be necessary to bridge these gaps.

Population Units

Research in population units is in a developing state. For example, the populations of Pacific salmon are reasonably well known in river phases and knowledge is accumulating rapidly on their distribution and mixing on the high seas. In a similar state is knowledge of Atlantic and Pacific herring, halibut, and sardines, Atlantic flounders, menhaden, and several others. The Bureau's plan gives priority to completing these studies in areas where the Government has primary responsibility.

Population Renewal

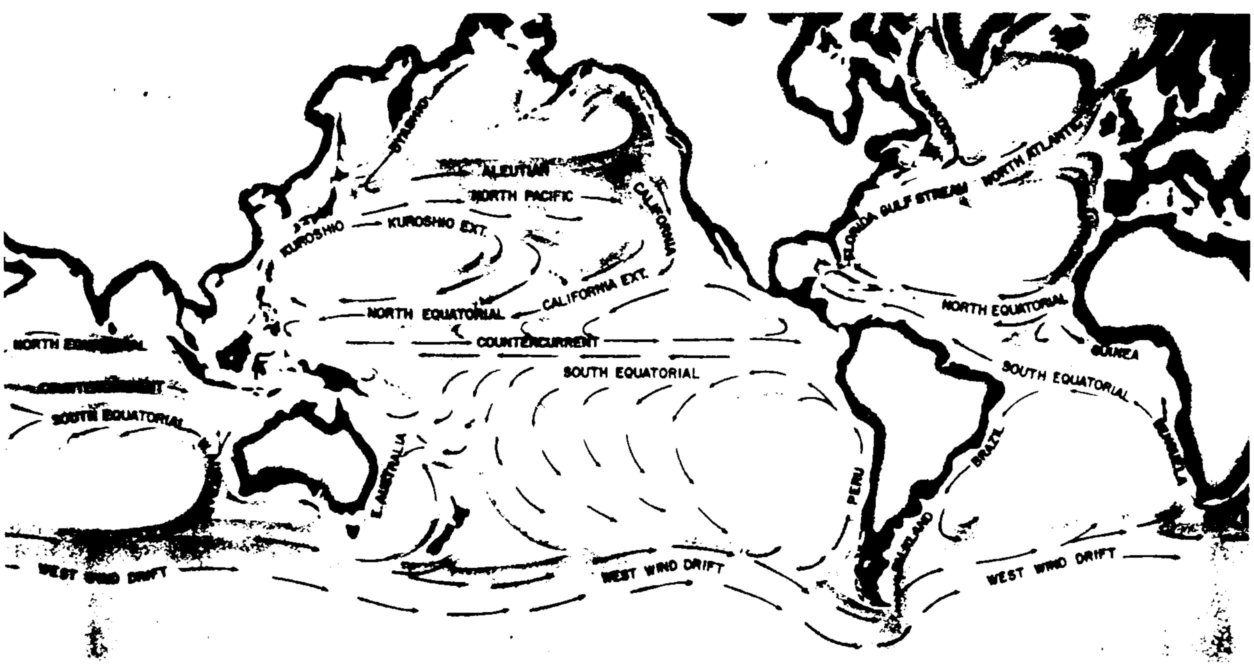
Population renewal characteristics have been determined for only a few of the important sea fishes, halibut, salmon, haddock, and even here only partially. Halibut research by the International Pacific Halibut Commission of which the United States is a member has demonstrated dramatically the beneficial effects of controlled fishing on the increase of weight of fish through growth. The effects of renewal through reproduction have not yet been determined, owing in part to the slow growth and long life of this species. For most major Pacific salmon stocks, the Bureau has demonstrated the relationship between numbers of spawners and numbers of adults that return to support the fishery or to renew the supply, and thus has improved vastly our ability to restore these valuable resources to levels of maximum yield. This is necessary if the conditions for abstention by foreign nationals from fishing certain stocks of fish in the North Pacific Ocean are to be upheld. For haddock, under study by the Bureau in discharge of its obligations under the International Commission for the Northwest Atlantic Fisheries, small fish are being protected through controlled mesh-size of trawl cod ends. Preliminary results show a gain of 20 percent in productivity from this control measure alone. The effects on renewal through reproduction will not be known for some time. Even with respect to the above-mentioned species, knowledge is yet far from perfect. Much more information is needed about the optimum population renewal for most species, even those which have been studied for many years.

Research for Management

These two long-pursued researches demonstrate several very important principles. First, different kinds of fish require different kinds of management. Radically different treatments were necessary to provide favorable results. Second, extensive research led to proper choice of treatment. Third, salutary management results can be obtained as soon as research is able to estimate the response of each fish stock to various rates of fishing.

Research Takes Time

Progress in this kind of research is slow because observations must extend through several generations of fish and because natural fluctuations obscure the effects of fishing. Progress has been slower than it will be in the future if adequate support is given to the employment of more well-qualified personnel and to the use of modern instruments and modern machine methods of handling data. The Bureau plan promises this needed support and proposes to give priority to those resources for which the Federal Government has primary responsibility and which are in greatest need of research.



The World Ocean, covering 73 percent of the earth's surface, will be called upon in the future to produce an ever-increasing quantity of human food.

Natural Fluctuations

Natural fluctuations in abundance and migrations of fish stocks are so little understood that they must receive substantial attention in Bureau plans. However, in this field the Bureau has begun to explore methods of attacking this problem. At its La Jolla laboratory, where the Bureau participates jointly with four California public and private institutions, and at its Woods Hole laboratory, where it is investigating North Atlantic fisheries in cooperation with 12 other nations, the Bureau is attacking the problem as it is manifested in two species, the pelagic sardine and the demersal haddock, about both of which much is already known biologically. A much smaller but equally important project conducted directly by the Bureau is the study of broad-scale oscillations in meteorological and oceanwide sea conditions in the Pacific and Atlantic Oceans in relation to the fluctuations of any fisheries for which sufficient biological and historical data exist.

Estuarine Protection

Many people think that only the rivers are affected by man's activities. But bay and estuarine fisheries for species such as the clam, crab, oyster, and shrimp are also affected by changes in the amount and quality of river flow. Further, their habitat is being increasingly altered by dumping of wastes and by engineering works in the estuaries and bays. Thus inshore waters are affected by pollution, by silting, and by physical changes such as channel dredging and "reclamation" of vast tidal areas. Natural conditions for the productivity of fish and shellfish in these waters can be improved after finding out what conditions are favorable for these fisheries. Then those conditions can be produced in bays and estuaries. The Bureau believes work in this field is most urgent and can be most rewarding in waters which are readily altered by man.

Pesticide Research

Pollution of our natural waters, including that from pesticides, poses a serious threat to the commercial fisheries of the U.S. This is true of the freshwater fisheries of the Great Lakes and the Mississippi River, the growing expanse of reservoirs created by dams; fisheries for salmon, shad, striped bass, and other important fishes which spawn in fresh water but live most of their lives in the sea; fisheries for shellfish or migratory marine or estuarine fishes of our coastal waters; or even the rapidly developing distant water high seas fisheries of the world.

That part of the Department's pesticide research program carried on by the Bureau of Commercial Fisheries has two objectives: To determine how chemicals can be used with advantage to improve fishery harvests and to guard against the adverse effects of pesticides in the aquatic environment, whatever their source.

Pesticides can be an important tool in controlling undesirable competitors and predators on important food fishes. Research is needed to study chemicals which attack certain animals, such as the pesticides which have been developed to kill larval sea lamprey in the Great Lakes. These chemicals are quite specific for the sea lamprey larvae and can be applied at very high dilution rates. Other examples are the specific chemicals which have been discovered to be effective in killing predators of oysters on oyster grounds. Obviously, adequate testing of these specific pesticides is necessary in order to protect the public welfare. Nevertheless, there are great advantages to be gained by the use of chemicals in undesirable species without harm to those that are desirable.

B-1

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DEPARTMENT OF THE INTERIOR
BUREAU OF COMMERCIAL FISHERIES
BIOLOGICAL LABORATORY
WOODS HOLE, MASSACHUSETTS

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1964 Programming Summary

Regular Funds

Program	Scientific Personnel	Other Direct	Total Direct	Tech & Adm.	Sub Total	Alb. IV	Total
Aquarium	26.7	6.0	32.7	9.3	42.0	-	42.0
Assessment of F. F.	36.1	4.0	40.1	16.0	56.1	24.5	80.6
Benthos	30.4	3.0	33.4	8.0	41.4	40.4	81.8
Cod	16.2	1.0	17.2	8.5	25.7	23.1	48.8
Experimental Studies	14.4	3.0	17.4	8.5	25.9	24.8	50.7
Flounder	9.4	5.0	14.4	18.1	32.5	25.0	57.5
Groundfish Ecology	39.2	6.0	45.2	34.0	79.2	28.0	107.2
Haddock	22.9	2.0	24.9	8.0	32.9	27.5	60.4
Total Regular	195.3	30.0	225.3	110.4	335.7	193.3	529.0

S/K Funds

Program	Scientific Personnel	Other Direct	Total Direct	Tech & Adm.	Sub Total	Alb. IV	Total
Hake	40.0	8.8	48.8	-	48.8	-	48.8
Oceanography	-	28.0	28.0	-	28.0	-	28.0
Plankton	17.1	1.0	18.1	14.7	32.8	-	32.8
Population Dynamics	41.1	6.0	47.1	28.9	76.0	-	76.0
Redfish	24.9	2.0	26.9	12.1	39.0	-	39.0
Sea Scallops	26.3	8.2	34.5	38.4	72.9	9.0	81.9
Total S/K	149.4	54.0	203.4	94.1	297.5	9.0	306.5
Grand Total	344.7	84.0	428.7	204.5	633.2	202.3	835.5

19 July 1963.

Analysis of Recent Budgets, Biological Laboratory, Woods Hole, Massachusetts.

F/Y	Number Biologists	Salary Costs Biologists	Number all Non-Vessel Personnel	Salary Costs All Non-Vessel Personnel	Vessel Operations Cost	Other Direct Costs	Total Allot-ment	Remarks
1965	22	$237,864	58	$470,879	$305,500 1/			
1964	22	219,957	58	450,176	202,300	$186,324	$838,800	Albatross IV operations budget 1964 is for 8 months.
1963	24	207,985	63	435,989	188,226	193,985	818,200 2/	$39,000 transferred to Delaware, $188,000 spent on Albatross IV.
1962	24	190,081	61	420,350	none	96,257	516,607	No funds allotted for vessel.
1961	20	165,778	54	368,493	110,000	122,217	490,710	$110,000 transferred to Delaware, Port Personnel Transferred from Woods Hole.
1960	20	148,596	62	345,688	110,000	109,687	565,375	$110,000 for Delaware operations.
1959	19	119,075	59	291,037	133,553	130,412	555,002	Albatross III laid up March 1959, $9,000 transferred to Delaware.
1958	23	133,152	62	293,289	171,010	89,686	553,985	
1957	22	125,202	60	277,557	191,544	107,392	576,493	

1/ Also need salary increases for shore based vessel personnel

Salary increase years: F/Y 1959, 1961, 1963.

WHOI Contract included in totals.

2/ Increases in 1963 included $77.0 for foreign fishing and $114.00 for vessel operations - Total $191.0.

Narrative Justification for Increases
Subactivity 131, Coastal and Offshore Research
Fiscal Year 1965

Need for Increase. An increase of $216,600 is needed in the groundfish investigations of the North Atlantic region for the following purposes:

A. To intensify our surveys of the groundfish populations of the North Atlantic which have recently been subjected to increased fishing pressure, particularly by the Russian fleet.

B. To make observations of environmental conditions and relate these to any observed changes in abundance of groundfish or relative successes of spawning.

C. To attempt to assess the total effect of the recent increased effort in terms of the wise utilization of the resource, and upon the availability of fish to the American fisherman.

Plan of Work. The ALBATROSS IV will be used in an intensive sampling program in the Northwest Atlantic, particularly on Georges Bank and surrounding waters.

Surveys of adult fish will be made throughout this area and throughout the year. Special cruises will be designed to estimate the abundance of immature fish, and extensive plankton collections will be made to estimate the extent of spawning, and the possible effect of fishing on the spawning stocks.

Examination of environmental conditions must be intensified in order to interpret intelligently the population changes which are observed. Estimates of abundance of eggs and larvae will be made and the fate of these planktonic stages will be followed. Variations in the success of year classes will be compared with the variations in fishing effort and in environmental conditions.

Conclusions arrived at will be used in advising management as to value of possible regulation of the fishing effort. This is an important committment of the United States to the International Commission for the Northwest Atlantic Fisheries.

Status of Program Statement

Coastal and Offshore Research, Subactivity 131

21 August 1963

The Woods Hole Laboratory programs are concerned with the populations of groundfish (cod, haddock, hake, flounder, redfish) and sea scallops in the Northwest Atlantic. Basic information is obtained on the natural fluctuations in abundance of these populations and upon the effects of fishing.

Monitoring the ever-changing age structure of the populations of the important species is a prime objective of the subactivity since such information is essential to predictive techniques and to the formulation of management proposals. Biological studies have now progressed to the point where such monitoring is conducted for Georges Bank haddock, New England yellowtail flounder, and Georges Bank sea scallop. Work on the other species has not yet reached this degree of refinement, but fluctuations in their population structures are recorded in terms of changing length distributions and indices of abundance.

Population structure of the fished populations is obtained from market samples of the important species. Information on the pre-recruits (fish smaller than those acceptable to the market) is obtained from surveys conducted by research vessels. On the basis of the combined information, reliable predictions have been made for cod, haddock, yellowtail flounder, redfish, and sea scallops. However, additional work on growth rates, ageing techniques, and sampling procedures is required in order to bring our predictions to a higher level of precision.

Overfishing is a constant threat in the commercial fisheries and it is the responsibility of the fishery biologist to recommend means by which a maximum sustained yield may be obtained. The Woods Hole Laboratory provides information used in formulating management measures for the groundfish of the Northwest Atlantic. These fisheries are managed through the International Commission for the Northwest Atlantic Fisheries. To date, cod, haddock, flounder, and redfish are under regulation in part or all of the Convention Area. Management measures for other species such as whiting and sea scallops are being considered and active research is being pursued toward this end.

Environmental studies are conducted in order to broaden our understanding of the causes of the changing abundance of fishes. These studies include studies of bottom sediments, benthic organisms, the physical and chemical conditions of the water and current patterns.

An understanding of the effects of environmental conditions on the abundance and availability of fishes is required in any intelligent appraisal of the effects of fishing effort on the stocks of fish.

Our research on the fishes of the North Atlantic has taken on a new urgency with the development of the Russian fishing fleet which has tremendously increased the effort on the already exploited stocks. Two years ago this fleet moved into waters close to home - Georges Bank - and began a heavy exploitation of herring stocks. Although these stocks of mature herring were of no interest to the American fisherman, it is our responsibility to determine the effects depletion of these stocks might have on the more desirable groundfish stocks.

Last year the Russian fleet turned its attention to whiting (Silver Hake) as well as herring. Exploiting this groundfish places them directly in competition with the United States fleet. This year we learn that the Russian fleet is taking other groundfish and have fished within a few miles of Cape Cod.

Russian biologists are making their own studies of these populations. It is essential that we have our own independent investigations to compare with theirs. Otherwise the International Commission for the Northwest Atlantic Fisheries will have only the Russians' conclusions upon which to make decisions regarding management.

The ALBATROSS IV is now in service and is being used to make intensive surveys in the critical areas. The data must be analysed promptly and results made quickly available in order to keep abreast of this rapidly expending fishery.

Form 2-102 (Rev. July 1963)

C -

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region #3, Gloucester, Massachusetts	
Subactivity (Symbol and Title) 131 Coastal & Offshore Research	Program Title: Vessel Operations	Program No. 430.7

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)			
21. Travel and Transportation of Persons			
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services (A15 XV)		9,000	9,000
26. Supplies and Materials			
31. Equipment			
Other			
Sub Total Program Direct Cost		9,000	9,000
Program Indirect Cost			
TOTAL OPERATING PROGRAM		9,000	9,000

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Benefiting Program			
431.03	Sea Scallops		9,000	9,000
	Sub Total Program Direct Cost		9,000	9,000
	Program Indirect Cost			
	TOTAL OPERATING PROGRAM		9,000	9,000

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: [signature] Name Title Date

Approved By: Herbert W. Graham Laboratory Director 7/29/69 Name Title Date

30579

Form 2-102 (Rev. July 1963)

Revision #1

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal & Offshore Research	Vessel Operations	130.7

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)	126,002		126,002
21. Travel and Transportation of Persons			
22. Transportation of Things			
23. Rent, Communications & Utility Services	700		700
24. Printing and Reproduction	17,000		17,000
25. Other Services	44,000		44,000
26. Supplies and Materials	5,598	+3,300	8,898
31. Equipment			
Other			
Sub Total Program Direct Cost	193,300	+3,300	196,600
Program Indirect Cost			
TOTAL OPERATING PROGRAM	193,300		196,600

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT (Ships)				Previous Program	This Action	Current Program
1	Personal Svcs	126,002		126,002			
2	Deck Dept.	1,667		1,667			
3	Engr'g	18,000		18,000			
4	Mess Dept.	11,667		11,667			
5	Electronics	1,667		1,667			
6	Vessel Repair	30,000		30,000			
7	Utilities	700		700			
8	Fishing Gear	3,597	+3,300	6,897			
	Benefiting Programs						
131.18	Flounder				25,000		25,000
131.33	Cod				23,100		23,100
131.34	Haddock				27,500	+ 3,300	30,800
131.35	Benthos				40,400		40,400
131.37	Experimental Studies				24,800		24,800
131.56	Groundfish Ecology				28,000		28,000
131.97	Asses. of Foreign Fishing				24,500		24,500
	Sub Total Program Direct Cost				193,300	+ 3,300	196,600
	Program Indirect Cost						
	TOTAL OPERATING PROGRAM				193,300	+ 3,300	196,600

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Herbert W. Graham (Name) Laboratory Director (Title) 10/28/63 (Date)

Approved By: ______ Name ______ Title ______ Date

C-8

Albatross IV

Personnel (name)	Title	12 mo. operation cost	
Benham	Fisherman	7,951	
Beattey	Master	13,119	
Benevento	2nd Asst.	8,348	
Berry	Messman	4,910	
Clapp	Fisherman	7,951	
Cusick	1st Officer	9,143	
Eldridge	Messman	4,910	
Ferreira	Fisherman	7,951	
Frontiero	Fisherman	7,951	
Grant	Fisherman	7,951	
Jones	Fisherman	7,951	
Laughead	Oiler	4,910	
Macinnes-Barker	Cook	7,951	
Merchant	Steward	8,746	
Stimberis	2nd Officer	8,746	
Webber	1st Asst. Engineer	7,951	
Welch	Fisherman	7,951	
Vadala	Fisherman	7,951	
Winslow	Chief Engineer	10,854	
			153.991

Shore Based

Oesendorf	Port Captain (GS 12)	10,506	
Rohig	Electronic Tech (GS9)	7,484	
Smith	Clerk (GS3)	4,190	
Watchman (WAE)	Uncl.	6,831	
			29,011

Temporary Employees (to provide for sick leave)	6,000
12 mo operation personal total	189,002

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8 mo. operation personal total	126,002

Equipment List

Dredge	500
Nets	4,000
Electronic Equipment	1,000

ALBATROSS IV BUDGET

FY 1965

I.	Vessel wages including 8% and sick leave replacement		$160,000
II.	Wages shore personnel including 8%	$23,280	
	Watchmen	10,000	
			33,280
III.	Stewards department--Food	23,700	
	Supplies and laundry	3,500	
			27,200
IV.	Engine department--Fuel	34,300	
	Lube and supplies	4,800	
			39,100
V.	Repairs		
	Haulout, main engine and gen., etc.	20,000	
	Repairs to equipment	12,000	
			32,000
VI.	Deck department--Supplies	4,800	
	Fishing gear	13,200	
			18,000
VII.	Electronics		2,500
VIII.	Utilities		3,900
	TOTAL		$315,980

December 31, 1963

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Mass.	Regional Office #3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
430-431 Coastal & Offshore Research	Technical & Administrative	430.1

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		72,135	72,135
21. Travel and Transportation of Persons		6,000	6,000
22. Transportation of Things		500	500
23. Rent, Communications & Utility Services			
24. Printing and Reproduction		2,000	2,000
25. Other Services			
26. Supplies and Materials		7,000	7,000
31. Equipment		6,465	6,465
Other			
Sub Total Program Direct Cost		94,100	94,100
Program Indirect Cost			
TOTAL OPERATING PROGRAM		94,100	94,100

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Administrative Offices		80,034	80,034
	Meeting Travel		5,000	5,000
	Library		9,066	9,066
	Benefiting Programs			
431.82	Redfish		12,100	12,100
431.83	Sea Scallops		38,400	38,400
431.74	Hake			
431.36	Plankton		14,700	14,700
431.20	Population Dynamics		28,900	28,900
	Sub Total Program Direct Cost		94,100	94,100
	Program Indirect Cost			
	TOTAL OPERATING PROGRAM		94,100	94,100

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63 Date

Personnel (name)	Grade	Cost
Dr. Graham	GS 15	16,319
Mackesy	11	9,499
Hilton	4	4,685
Leonard	7	6,868
Kiernan	6	6,665
Cairns	4	5,403
Howe	4	4,960
Philpott	4	4,887
Goulart	3	4,158
Deacon	3	4,352
McConnell	3	4,201
Total personal services		**72,135**

Equipment List

Aluminum Skiff	300
Motors	1,000
Outboards	200
Stencil Cutter	300
Power Hack Saw	500
Bathythermographs	3,000

Form [illegible]102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal & Offshore Research	Technical & Administrative	130.1

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		77,875	77,875
21. Travel and Transportation of Persons		1,500	1,500
22. Transportation of Things			
23. Rent, Communications & Utility Services		10,000	10,000
24. Printing and Reproduction		3,000	3,000
25. Other Services			
26. Supplies and Materials		12,525	12,525
31. Equipment		5,500	5,500
Other			
Sub Total Program Direct Cost		110,400	110,400
Program Indirect Cost			
TOTAL OPERATING PROGRAM		110,400	110,400

BREAKDOWN BY PROGRAM FEATURE

NOTED BY REGIONAL OFFICE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Station Maintenance		81,196	81,196
	Instrumentation		14,169	14,169
F	Photography		8,566	8,566
G	Drafting		6,469	6,469
	Benefiting Programs			
131.18	Flounder		18,100	18,100
131.33	Cod		8,500	8,500
131.34	Haddock		8,000	8,000
131.35	Benthos		8,000	8,000
131.37	Experimental Studies		8,500	8,500
131.56	Groundfish Ecology		34,000	34,000
131.73	Aquarium		9,300	9,300
131.97	Assessment of Foreign Fishing		16,000	16,000
	Sub Total Program Direct Cost		110,400	110,400
	Program Indirect Cost			
	TOTAL OPERATING PROGRAM		110,400	110,400

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name [signature] Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63
Name Title Date

Personnel (name)	Grade	Cost	
Cressen	GS 10	9,160 ✓	
Ashmore	5	5,469 ✓	
Brigham	9	7,556 ✓	
Macaulay	11	9,348 – not in 19	
Costa	Uncl.	6,270 ✓	
Almeida	Uncl.	6,088 ✓	
Neal	Uncl.	6,088 ✓	
Loring	Uncl.	6,088 ✓	
Polley	Uncl.	4,968 ✓	60,986

Summer students			
(A)	GS 4	1,127	
(B)	3	1,036	
(C)	2	986	
(D)	2	962	4,089 –
Overtime	-	12,800	12,800 in
Total personal services			77,875

Equipment List

Automobile	2,000
Refrigerator	200

Table I. New England Landings[2/] (Thousands of pounds, round-fresh and thousands of dollars ex-vessel)

Year	Groundfish Lbs.	Groundfish $	Pelagic fish Lbs.	Pelagic fish $	Shellfish Lbs.	Shellfish $	Total Lbs.	Total $
1930	551,316	17,550	144,930	3,227	55,777	8,261	752,023	29,038
1931	535,037	12,610	114,317	2,815	44,209	6,323	693,563	21,748
1932	393,261	8,408	106,641	1,638	39,603	4,817	539,505	14,863
1933	405,011	8,787	96,611	1,534	38,315	3,893	539,937	14,214
1934	454,888	9,826	---	--	---	--	---	---
1935	545,756	11,716	128,540	2,014	46,294	5,445	720,590	19,175
1936	590,571	13,170	---	--	---	--	---	---
1937	554,423	12,832	83,779	1,607	55,697	6,414	693,899	20,853
1938	550,710	11,283	68,713	1,790	50,322	6,261	669,745	19,334
1939	547,236	12,751	---	--	---	--	---	---
1940	525,078	13,831	85,885	1,469	49,962	6,297	660,925	21,597
1941	671,608	17,666	---	--	---	--	---	---
1942	553,995	25,971	51,610	2,607	20,461	4,654	626,066	33,232
1943	527,467	31,185	60,040	3,655	16,882	4,529	604,389	39,369
1944	576,826	30,087	65,980	3,365	15,867	4,554	658,673	38,006
1945	692,086	38,431	151,040	6,313	51,794	15,941	894,920	60,685
1946	654,101	38,789	131,027	5,150	60,912	20,521	846,040	64,460
1947	606,471	33,042	177,133	4,733	63,722	20,562	847,326	58,337
1948	738,710	41,756	241,321	7,094	59,046	21,644	1,039,077	70,494
1949	763,617	35,179	207,585	4,682	68,543	19,960	1,039,745	59,821
1950	738,229	31,086	226,631	3,023	64,884	21,295	1,029,744	55,404
1951	777,375	43,753	93,700	2,237	66,712	22,315	937,787	68,305
1952	731,522	38,852	209,512	3,598	61,810	26,173	1,002,844	68,623
1953	669,817	32,977	167,969	3,376	72,128	26,570	909,914	62,923
1954	765,637	32,120	201,131	3,340	61,803	23,220	1,028,571	58,680
1955	778,436	29,832	195,948	3,050	63,357	25,630	1,037,741	58,512
1956	794,395	30,691	243,538	4,191	58,675	25,722	1,096,608	60,604
1957	774,544	31,417	229,820	3,843	67,819	26,225	1,072,183	61,485
1958	716,702	35,506	237,137	4,272	60,321	26,158	1,014,160	65,936
1959	728,417	34,104	195,203	3,728	64,150	29,441	987,770	67,273
1960	605,686	30,460	221,098	3,876	69,401	27,725	896,185	62,061
1961	604,876	30,191	111,982	2,322	70,672	28,754	787,530	61,267
1962	622,766	32,923	134,952	--	74,818	--	832,536	---
1963[1/]	596,610	33,812	---	--	----	--	---	---

1/ Estimated from 1963 O. S. S. (BFC) production/value tables.

2/ Source: Fishery Statistics of the United States, Statistical Digests, Fish and Wildlife Service, U. S. Dept. of the Interior.

Table II. New England Landings of Major Species 1/ (thousands of pounds, round-fresh and thousands of dollars, ex-vessel).

Year	Cod lbs.	Cod $	Haddock lbs.	Haddock $	Redfish lbs.	Redfish $	Yellowtail 2/ lbs.	Yellowtail 2/ $	Silver Hake lbs.	Silver Hake $	Industrial lbs.	Industrial $	Scallops lbs.	Scallops $
1930	88,769	3,043	278,990	8,983	-	-	-	-	9,863	108	-	-	-	-
1	79,872	2,378	203,173	6,054	-	-	-	-	8,071	82	-	-	-	-
2	76,171	1,725	171,418	3,874	-	-	-	-	7,201	61	-	-	-	-
3	88,309	1,856	171,387	3,908	264	-	-	-	9,419	97	-	-	-	-
4	102,985	2,225	168,721	3,172	1,842	-	-	-	-	-	-	-	-	-
5	103,166	2,514	206,919	4,552	17,157	-	-	-	17,415	182	-	-	-	-
6	94,733	1,958	188,733	4,379	66,592	-	-	-	-	-	-	-	-	-
7	117,646	2,657	180,057	4,429	58,356	-	19,673	437	22,480	258	-	-	-	-
8	107,885	2,211	178,110	3,901	65,005	-	19,549	452	25,095	274	-	-	-	-
9	94,821	2,321	180,740	4,862	77,375	-	23,898	449	28,055	-	-	-	-	-
1940	72,246	2,503	159,666	5,205	85,142	-	35,284	653	40,869	336	-	-	-	-
1	93,843	2,669	193,162	8,905	145,387	-	47,794	1,348	-	-	-	-	-	-
2	57,805	3,395	148,115	8,872	128,090	-	66,681	2,687	46,870	1,676	76	2	-	-
3	57,928	4,784	128,772	10,109	114,737	-	45,785	3,210	53,997	1,334	534	25	5,529	2,330
4	80,649	5,530	146,493	9,786	120,216	-	31,033	1,896	51,788	1,149	654	21	4,869	1,614
5	121,394	8,565	159,738	10,974	131,834	5,067	33,799	2,150	77,664	1,928	219	7	5,711	1,887
6	78,146	5,782	160,201	13,409	178,149	7,749	32,145	1,990	51,080	1,206	1,746	63	11,617	6,568
7	55,615	3,675	170,178	11,691	146,587	5,925	36,419	2,254	61,982	1,379	2,599	101	14,654	7,217
8	59,495	4,303	163,442	12,928	238,092	9,647	39,589	4,196	80,468	1,817	5,203	204	16,636	8,719
9	51,979	3,377	139,170	9,547	236,987	9,819	28,684	2,734	90,036	1,920	35,610	437	18,296	6,764
1950	48,022	3,250	162,133	12,095	207,793	9,137	24,394	2,564	65,464	1,338	100,699	1,023	19,980	9,203
1	43,891	3,318	153,291	11,880	258,308	12,597	16,187	2,097	118,466	2,804	56,451	1,048	18,746	8,323
2	35,884	2,994	161,341	12,492	189,030	8,210	14,747	1,739	105,955	2,217	53,012	458	18,630	10,831
3	27,309	2,116	139,494	10,518	153,894	5,972	12,569	1,243	85,365	1,570	88,712	811	23,618	10,477
4	29,258	2,050	154,895	10,008	181,448	7,376	10,275	1,056	90,386	1,835	133,715	1,262	17,631	7,976
5	26,984	1,874	135,029	8,100	156,987	6,038	12,657	1,325	110,630	1,833	136,900	1,214	22,125	11,450
6	27,758	1,969	152,193	9,583	151,113	5,723	11,745	1,196	90,090	1,543	139,080	1,201	20,066	10,822
7	27,070	1,941	133,409	10,186	133,931	5,088	19,904	1,843	126,312	2,213	189,268	1,556	20,994	10,180
8	32,214	2,718	119,551	11,732	148,645	6,275	29,510	2,635	106,650	2,326	154,997	1,294	18,977	9,139
9	34,538	2,842	112,622	10,938	136,703	5,665	25,913	2,885	110,144	2,110	152,990	1,268	24,644	11,804
1960	29,936	2,244	118,610	9,391	141,433	5,420	27,685	2,732	103,637	2,262	34,281	263	26,600	9,515
1	35,798	2,581	133,536	9,901	132,062	5,114	34,667	2,955	93,945	1,996	48,745	272	27,461	10,404
2	37,434	2,872	134,169	10,903	123,983	-	50,844	3,825	97,737	2,039	58,787	387	23,500	9,500
3/ 3	30,129	2,458	127,606	11,430	107,000 (Est.)	-	67,537	4,590	92,000	2,223	57,508	246	19,740	9,227

1/ Source Fishery Statistics of U.S.
2/ 1937 - 1950 data from ICNAF Doc. VII 1951 - 1962 from C.F.S. Bulletins, Massachusetts Landings.
3/ Estimated from O.S.S. (BCF Gloucester, Massachusetts) tables on 1963 production/value New England Fish Landings.

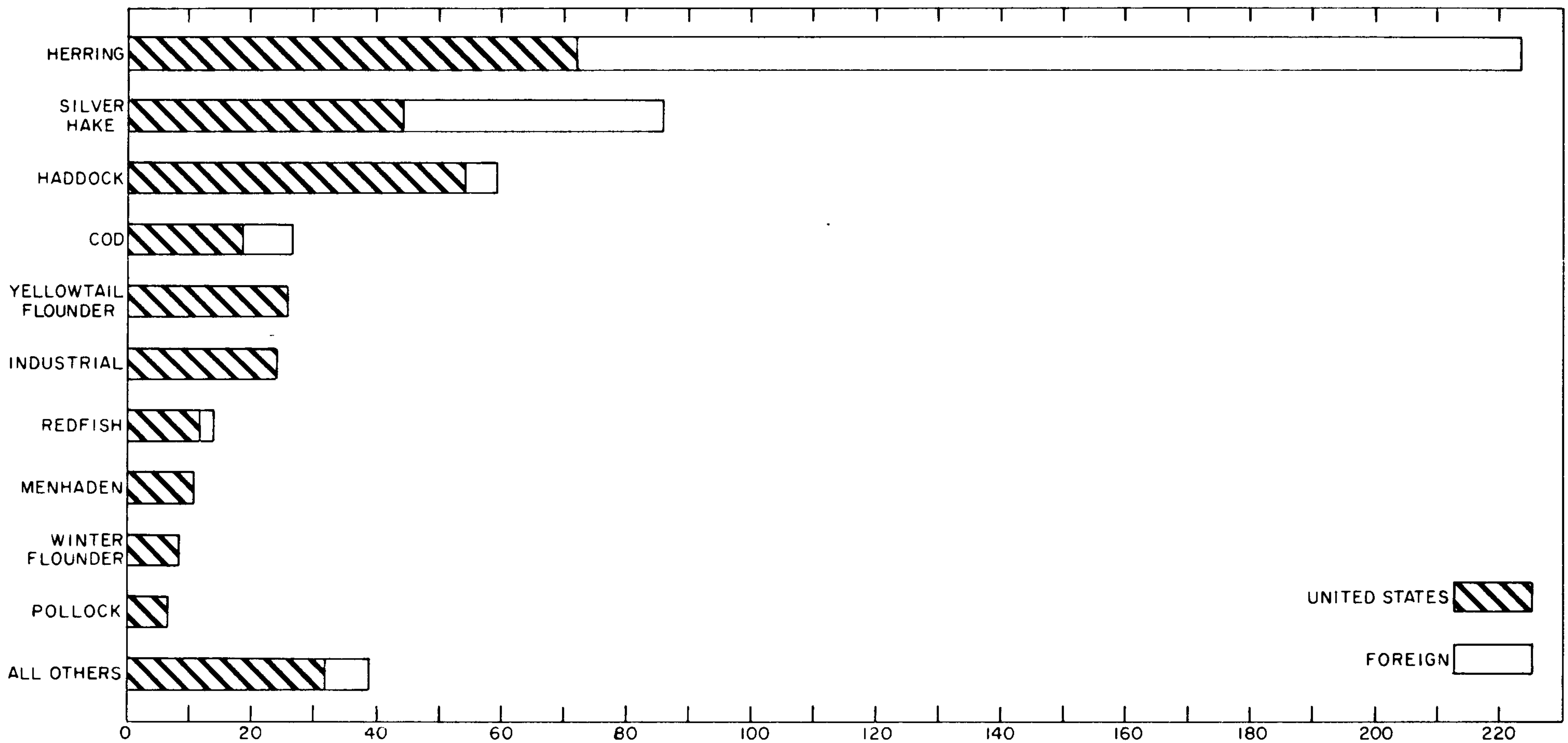
1962 LANDINGS--THOUSANDS METRIC TONS (ROUND, FRESH)

FINFISH ONLY

SPECIES	SUBAREA 5 Total	SUBAREA 5 (%)	SUBAREA 5 U.S.	SUBAREA 4 Total	SUBAREA 4 (%)	SUBAREA 4 U.S.
Herring	223	(42)	72	116	(22)	0
S. hake	86	(16)	44	9	(2)	--
Haddock	59	(11)	54	44	(8)	6
Cod	27	(5)	19	219	(41)	1
Yellowtail flounder	26	(5)	26	9	(2)	--
Industrial [1)]	24	(4)	24	--	--	--
Redfish	14	(3)	12	43	(8)	29
Menhaden	11	(2)	11	--	--	--
Winter flounder	8	(2)	8	3	--	--
Pollock	6	(1)	6	33	(6)	2
All other *	39	(7)	32	54	(10)	2
Total	523	(100)	307	530	(100)	40

	Subarea 5	Subarea 4
*Halibut	+	2
American Plaice	2	7
Witch	1	9
Fluke	2	--
Scup	4	--
Tautog	+	--
Sea robin	+	--
Tilefish	+	--
Wolffish	+	1
White hake	2	10
Red hake	2	
Cusk	1	4
Anglerfish	+	--
Swellfish	+	--
Sand eel	+	--
Mackerel	1	6
Tuna	3	+
Bonita	+	--
Swordfish	1	2
Bluefish	+	--
Butterfish	3	--
Anchovy	+	--
Sharks	+	--
Skates and rays	+	+
Dogfish	+	--
Sturgeon	+	+
Sea bass	+	+
Alewife	5	5
Shad	+	+
Smelt	+	1
Conger eel	+	--
Eel	+	+

1)--Mostly silver and red hake.



1962 LANDINGS - SUBAREA 5
FINFISH ONLY
(Thousands Metric Tons - round, fresh)

LIST OF SPECIES WITH NAMES USED IN THE STATISTICAL BULLETIN

AND SCIENTIFIC NAMES

Name used in Statistical Bulletin	Scientific Name
Alewife	Alosa pseudoharengus (Wils.)
American Plaice	Hippoglossoides platessoides (Fab.)
Anchovy	Anchovia mitchilli (C. et V.)
Anglerfish	Lophius americanus C. et V.
Bay scallop	Pecten irradiens
Bluefin tuna	Thunnus thynnus (L.)
Bluefish	Pomatomus saltatrix (L.)
Bonito	Sarda sarda (Bloch)
Butterfish	Poronotus triacanthus (Peck)
Capelin	Mallotus villosus (Muller)
Cod	Gadus morhua L.
Conch	Strombus et Busycon spp.
Conger	Conger oceanica (Mitch.)
Crabs	Callinectes et Cancer spp.
Crevalle	Caranx hippos (L.)
Cunner	Tautogolabrus adspersus (Walb.)
Cusk	Brosme brosme (Muller)
Dogfish	Squalus and Mustelus spp.
Eel	Anguilla rostrata (LeSueur)
Eelpout	Macrozoarces americanus (Bl. et Schn.)
Fluke	Paralichthys dentatus (L.)
Greenland Halibut	Reinhardtius hippoglossoides (Walb.)
Haddock	Melanogrammus aeglefinus (L.)
Halibut	Hippoglossus hippoglossus (L.)
Hard clam	Mercenaria mercenaria (L.)
Herring	Clupea harengus L.
King whiting	Menticirrhus saxatilis (Bl. et Schn.)
Ling	Molva molva (L.)
Lobster	Homarus americanus M. Edw.
Lumpfish	Cyclopterus lumpus L.
Mackerel	Scomber scombrus L.
Menhaden	Brevoortia tyrannus (Latrobe)
Mussel	Mytilus edulis L., Voicella (Modiolus)
Ocean quahog	Arctica (Cyprina) islandica L.
Oyster	Crassostrea virginica (Gmelin)
Periwinkle	Littorina et Lunatia spp.
Pollock	Pollachius virens (L.)
Porbeagle	Lamna nasus (Bonn.)
Prawns	Pandalus borealis Kr.
Razor clam	Ensis directus (Conrad)
Redfish	Sebastes marinus (L.)
Red hake	Urophycis chuss (Walb.)
Salmon	Salmo salar L.
Sand eel	Ammodytes spp.
Scup	Stenotomus versicolor (Mitch.)

LIST OF SPECIES WITH NAMES USED IN THE STATISTICAL BULLETIN AND SCIENTIFIC NAMES

Name used in Statistical Bulletin	Scientific Name
Sea bass	Centropristes striatus (L.)
Sea robin	Prionotus carolinus (L.)
Sea scallop	Placopecten magellanicus Gmelin
Sea urchins	Strongylocentrotus spp.
Seaweed	Rhodymenia, Chondrus, Laminaria, etc.
Shad	Alosa sapidissimi (Wils.)
Silver hake	Merluccius bilinearis (Mitch.)
Skates	Raja spp.
Skipjack tuna	Katsuwonis pelamis
Smelt	Osmerus mordax (Mitch.)
Soft clam	Mya arenaria L.
Spotted Wolffish	Anarichas minor Olafsen
Squeteagues	Cynoscion regalis (Bl. et Schn.)
Squid	Loligo et Illex spp.
Striped bass	Roccus saxatilus (Walb.)
Striped wolffish	Anarhichas lupus L.
Sturgeon	Acipenser oxyrhyncus, Mitchell
Swellfish	Sphaeroides maculatus (Bl. et Schn.)
Swordfish	Xiphias gladius L.
Tautog	Tautoga onitis (L.)
Tilefish	Lopholatilus chamaeleonticeps G. et B.
Tomcod	Microgadus tomcod (Walb.)
Trout	Salvelinus spp.
White hake	Urophycis tenuis (Mitch.)
White perch	Roccus americanus (Gmelin)
Winter flounder	Pseudopleuronectes americanus (Walb.)
Witch	Glyptocephalus cynoglossus (L.)
Worms	Glycera et Neanthes (Mereis) spp.
Yellowfin tuna	Thunnus albacares
Yellowtail	Limanda ferruginea (Storer)

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*Credit for publication goes to Boothbay Harbor Laboratory, headquarters of senior author.

MEMORANDUM OF AGREEMENT

WHEREAS the Fish and Wildlife Service of the United States Department of the Interior and the Marine Biological Laboratory of Woods Hole, Massachusetts, are engaged in basic studies of the ocean and of marine biology, and

WHEREAS active cooperation has existed and exists between those agencies in the prosecution of such studies through the exchange of consultative services and library facilities, and

WHEREAS the Marine Biological Laboratory has need for additional research laboratory space for use of its investigators, and

WHEREAS the Fish and Wildlife Service has need for continued use of the library facilities of the Marine Biological Laboratory,

NOW, THEREFORE, the Fish and Wildlife Service, hereinafter referred to as the Service, and the Marine Biological Laboratory, hereinafter referred to as the Cooperator, agree, contingent upon the availability of funds, as follows:

1) The Service will provide laboratory space for six (6) investigators of the Cooperator in the Service's laboratory at the Woods Hole, Massachusetts station without charge therefor. Such investigators of the Cooperator shall be subject to all of the rules and regulations governing safety, maintenance, and conduct in the laboratory.

2) Without charge therefor the Cooperator will provide scientific workers of the Service at its Woods Hole, Massachusetts, station with live material needed in their official investigations, and ordinary apparatus, chemicals, and glassware: provided that live material shall include only those forms which can be collected by the Cooperator. Other living material and special apparatus, glassware, and chemicals will be provided by the Cooperator subject to the same fees charged the Cooperator's investigators.

3) The Cooperator will permit the use of its library facilities by Service personnel while conducting their official duties to the same extent as such facilities are offered its own investigators.

4) The Service will provide ordinary maintenance and utilities in its laboratory for the benefit of personnel of the Cooperator as well as of the Service.

5) No member of or delegate to Congress, and no Resident Commissioner, shall be admitted to any share of this agreement or to any benefit to arise therefrom, provided, however, that nothing herein shall be construed to limit this agreement if made with a corporation for its general benefit.

6) This agreement shall remain in full force and effect until and unless terminated by notice in writing by one of the parties hereto not less than sixty (60) days in advance of the proposed termination date.

IN WITNESS WHEREOF, the duly authorized representatives of the parties hereto have affixed their signatures as of the dates set forth opposite their signatures.

May 23, 1949
Date

Albert M. Day
Director, Fish and Wildlife Service
U. S. Department of the Interior

May 16, 1949
Date

Charles Packard
Director, Marine Biological Laboratory

THE THREE SCIENTIFIC INSTITUTIONS IN WOODS HOLE: THEIR LIBRARIES

I. MARINE BIOLOGICAL LABORATORY. Founded 1888

Library: The largest biological library in the world, it receives 1800 serial subscriptions each year and currently holds about 100,000 books and bound volumes of periodicals. Because of the complete nature of the M.B.L. LIBRARY in its field, and its proximity, the Woods Hole Oceanographic Institution has not established a separate library. Instead, contributions are made to the holdings of M.B.L. LIBRARY, which thus becomes the main library resource for both institutions.

II. WOODS HOLE OCEANOGRAPHIC INSTITUTION. Founded 1930

Document Library: A collection of more than 15,000 internal reports and unpublished technical reports and similiar material of limited distribution, both unclassified and classified.

III. FISH & WILDLIFE SERVICE, BUREAU OF COMMERCIAL FISHERIES, BIOLOGICAL LABORATORY. Founded 1875

Library: A specialized library in fishery biology and related fields. It receives 250 serials and journals yearly, plus short runs and State Reports, and holds approximately 1000 book titles and 1500 bound periodicals.

NOTE: These libraries are not connected although their holdings complement one another and the librarians cooperate whenever the need arises. Interlibrary loan and technical information requests should be directed to the proper library as follows:-

1. Books, serials, and citations from the published literature:
   MARINE BIOLOGICAL LABORATORY
   Library
   Woods Hole, Mass. 02543

2. Internal Woods Hole Oceanographic Institution reports, reference numbers, and oceanographic information:
   DOCUMENT LIBRARY LO-206
   W.H.O.I.
   Woods Hole, Mass. 02543

3. Fishery biology information and references:
   U.S. FISH & WILDLIFE SERVICE
   BUREAU OF COMMERCIAL FISHERIES
   Biological Laboratory Library
   Woods Hole, Mass. 02543

UNIVERSITY RIGHTS BY DEED OF LAND

Galtsoff, 1962, The Story of the Bureau of Commercial Fisheries Biological Laboratory Woods Hole, Massachusetts. Circular 145, pp. 29-30 - "To obtain the contributions, Baird offered the universities continuous use of research tables in the proposed laboratory. In a letter of September 3, 1881, to Forbes, Baird wrote as follows: '. . . . . I have written to Alexander Agassiz asking him if he would like to join in the enterprise and promising him a perpetual right to a table in the laboratory and the facilities of the station to be utilized by anyone he may designate. This is the system adopted at the Naples Aquarium, where establishment by this means has been successfully maintained.'

Baird (1885, p. LIV) states: 'The colleges in question and Mr. Agassiz made their contributions with the understanding that, as far as possible, they were each allowed to send one specialist to the station for the purpose of carrying on scientific research.' This promise was continued to be honored by his successors. On one occasion, in May, 1895, Commissioner McDonald denied the privilege and stated 'this agreement, as a matter of contract, is not authorized by law; as a metter of courtesy, it has been and will be carried out unless something intervenes to make it impossible.' (Letter on file at the Bureau of Commercial Fisheries Biological Laboratory at Woods Hole.) Conklin (1944) writes that 'when, on one occasion, this privilege was cancelled by a Commissioner of Fisheries, Mr. Agassiz fought the order with characteristic vigor, and it was rescinded.'"

Abbiati, 1956, Report of encroachments on lands of the United States at Woods Hole. Typed memorandum to Regional Director, Boston 11, Massachusetts. February 20, 1956. pp. 2-3. "I found no further information with regard to the rights to a table in the laboratory in the files, excepting a letter of March 27, 1883 from Dr. Samuel F. Clark to Professor Baird which reads in part as follows: '. . . I am going abroad and the College folks have requested me to ask you for some paper in case of our death to show that Williams is entitled to a representation at Woods Hole.' In discussing the question of a right to a table with Mr. Bailey of the Regional Office, he informed me he remembers various individuals from colleges and museums making an annual trip to Woods Hole and using Service facilities during summer months for various biological investigations. He also informed me that at the time of the Second World War, when the Woods Hole Station was taken over by the Woods Hole Oceanographic Institute, that the various contributors were notified by the Service of the action being taken and that facilities at the Woods Hole Station would not be available to them for some time. Mr. Bailey is of the opinion that some of these early contributors relinquished their rights to the use of the Woods Hole Station. The question of the right to a table at Woods Hole remained unresolved.'"

Report of the Commissioners for 1883 (1885) vol. 11, p. LIV. "The colleges in question and Mr. Agassiz made their contribution with the understanding that, as far as possible, they were each to be allowed to send one specialist to the station for the purpose of carrying on scientific research."

SCHEDULE OF ALBATROSS IV CRUISES

Cruise No.	Dates	Purpose of Cruise and Area Covered	Chief of Party
	1963		
63-1	May 13-17	Collect quantitative samples of the sea scallop population on Georges Bank.	Posgay
63-2	May 25-June 6	To show the vessel to various interested groups at Washington, D. C., and to collect biological data at several stations on the return trip.	Fritz
63-3	June 10-13	Collect quantitative samples of the Georges Bank sea scallop population.	Posgay
63-4	June 18-23	To determine the periodicities in the feeding behavior of the common species of marine fishes. To determine the quantities of feed taken daily by these fishes. To investigate the feasibility of determining both feeding periodicity and quantity eaten by the analysis of changes in glycogen shortage in the liver.	Edwards
63-5	July 18-Aug. 1 Aug. 7-19	To determine the distribution and abundance of young-of-the-year haddock and other fishes common to the area between the Bay of Fundy and Hudson Canyon.	Fritz Marak
63-6	Sept. 5-9	Collect quantitative samples of the sea scallop population on Georges Bank.	Posgay
63-7	Nov. 13-27 Dec. 2-16	To determine the distribution and abundance of young-of-the-year haddock and other fishes common to the area between the Bay of Fundy and Hudson Canyon.	Fritz Marak

Cruise No.	Dates	Purpose of Cruise and Area Covered	Chief of Party
	1963		
63-8	Dec. 18-19	To occupy foreign fishing program hydrographic and plankton sampling station #5 at 40° 20' N, 69° 55' W.	Miller

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF COMMERCIAL FISHERIES

BIOLOGICAL LABORATORY, WOODS HOLE

ALBATROSS IV

CRUISE SCHEDULE, CALENDAR YEAR 1964

CRUISE NO.	DATE	AREA	PURPOSE	DAYS
64-1	Jan. 16-30 Feb. 4-18	Nova Scotia to New Jersey	Winter Groundfish Survey (BT, F, I, Be)	15 15
64-2	Feb. 24-Mar. 9	Nova Scotia to New Jersey	Oceanographic Survey Ecosystem Dynamics (I, P, Ch, BT, Sa, T)	15
64-3	Mar. 16-26	Browns Bank-Georges Bank	Haddock Biology (BT, F, I)	11
*	Mar. 30-Apr. 10		Annual Overhaul	12
64-4	Apr. 14-23	Georges Bank	Flounder tagging (BT, F, I)	10
64-5	May 4-15	Georges Bank	Sea Scallop Survey (BT, F)	12
64-6	May 25-June 9	Nova Scotia to New Jersey	Oceanographic Survey Ecosystem Dynamics (I, P, Ch, BT, Sa, T)	15
64-7	June 15-26	Georges Bank	Benthic Survey (B, BT, Be)	12
64-8	July 14-28 Aug. 3-17	Nova Scotia to New Jersey	Summer Groundfish Survey (BT, F, I, Be)	15 15
64-9	Aug. 24-Sept. 6	Nova Scotia to New Jersey	Oceanographic Survey Ecosystem Dynamics (I, P, Ch, BT, Sa, T)	14
64-10	Sept. 14-25	Georges Bank	Sea Scallop Survey (BT, F)	12
64-11	Oct. 5-19 Oct. 26-Nov. 9	Nova Scotia to New Jersey	Fall Groundfish Survey (BT, F, I, Be)	15 15
64-12	Nov. 12-25	Nova Scotia to New Jersey	Oceanographic Survey Ecosystem Dynamics (I, P, Ch, BT, Sa, T)	14

ALBATROSS IV

CRUISE SCHEDULE, CALENDAR YEAR 1964 (Cont.)

CRUISE NO.	DATE	AREA	PURPOSE	DAYS
64-13	Nov. 30-Dec. 4	Southern New England	Experimental Studies (BF, BT, F, I)	5
64-14	Dec. 7-14	Southern New England	Experimental Studies (BF, BT, F, I)	12

December 9, 1963

#1167

PROGRAM

for the

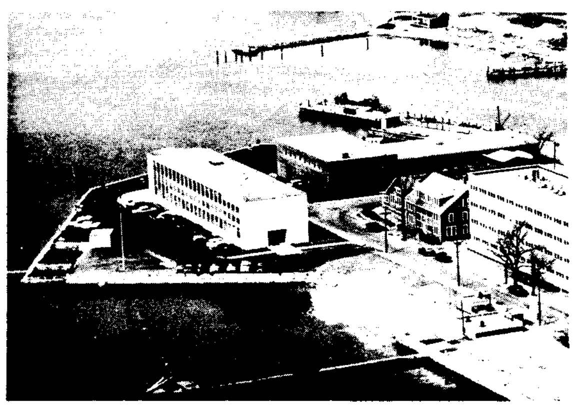
DEDICATION

of the

BUREAU OF COMMERCIAL FISHERIES

BIOLOGICAL LABORATORY

Woods Hole, Massachusetts



June 23, 1962

United States Fish and Wildlife Service
Department of the Interior

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Woods Hole Oceanographic Institution, Woods Hole, Mass.

DEDICATION PROGRAM

National Anthem

Mrs. Fred Nichy

Invocation

Reverend Father Edwin J. Loew

Introduction

David H. Hart
Chairman, Atlantic States Marine Fisheries Commission

Welcome to the Commonwealth

Charles H. W. Foster
Commissioner, Department of Natural Resources
Commonwealth of Massachusetts

Welcome to Community

John DeMello, Jr.
Chairman, Board of Selectmen, Falmouth, Massachusetts

Scientific Address

Dr. Detlev W. Bronk
President, The Rockefeller Institute

Dedicatory Address

D. Otis Beasley
Administrative Assistant Secretary
Department of the Interior

Benediction

Reverend Edgar Lockwood

Guests are invited to visit the Laboratory and Aquarium
after the Ceremony

WOODS HOLE - CENTER OF MARINE SCIENCES

Woods Hole, Massachusetts, has been an active center of marine research since the 1870's. In that decade Spencer F. Baird, U.S. Commissioner of Fisheries, and a staff of scientists conducted studies of the local fishes in summer at the Lighthouse Station in Little Harbor, while Louis Agassiz founded the Anderson School of Natural History on nearby Penikese Island where students came to study marine life under his inspiring tutelage.

After several summers at Little Harbor and elsewhere at various points along the Atlantic Coast, Spencer Baird was convinced that Woods Hole was the ideal spot for a permanent fishery laboratory. As a result of his interest and diligence, suitable land was acquired by the Government upon which a permanent laboratory was constructed in 1885. These buildings served the purposes of the "Fisheries", as the fisheries laboratory is usually called locally, until 1958 when they were razed to make way for the present structures.

The laboratory on Penikese was short-lived due to the remoteness of the island and lack of financial support, but the spirit of Agassiz and the general interest in a summer school for biologists and students was carried over to the organization of another laboratory which became established in Woods Hole. The Women's Education Association of Boston raised $10,000. which were used in the purchase of land and erection of buildings for the "Marine Biological Laboratory" in 1888. The first "MBL" building was a very modest frame structure with few facilities. The investigators depended upon the Fish Commission for vessels to collect marine animals and plants and for the saltwater supply to maintain them ashore. Through the generosity of individuals and private foundations, this Laboratory enjoyed a continuous growth and today boasts many permanent buildings, an outstanding library, and the best of laboratory equipment, particularly in the fields of physiology and biochemistry.

This Laboratory still functions primarily as a summer laboratory where biologists come from universities and research institutions from all parts of the country and foreign lands to carry on their researches. The organization of the "MBL" is unusual in that it is owned by the biologists themselves, many of whom return to Woods Hole each summer to carry out their investigations. Financial support comes largely from universities through rental fees for rooms and tables occupied by their teaching staffs and students. An endowment fund has been built up over the years from funds contributed by private individuals and foundations. These funds have not been adequate in recent years to meet all the demands for space so than an appeal to the Federal Government for help resulted in a grant from the National Science Foundation and the National Institutes of Health which was used to match funds contributed by the Rockefeller Foundation for the construction of their newest laboratory completed in 1960.

The Marine Biological Laboratory has a long history of scientific achievement. Although it has no year-round resident scientific staff, it deserves credit for the discoveries made by its corporate members, and visiting investigators. The accomplishments of these researchers reflects the progress in biological science in the country as a whole. The work here has always focussed on fundamental principles of biology rather than on the study of marine organisms per se, and on instruction offered to advanced students. Some of the outstanding discoveries in the fields of embryology, genetics, cytology, ultrastructure, physiology, and biochemistry were made in Woods Hole.

The "MBL" offers an unusual opportunity for students to spend two months of the summer dedicated to science in an atmosphere of research where they can associate with leading biologists, and attend courses in embryology, physiology, marine invertebrates, marine botany, and ecology.

The third and largest scientific institution in Woods Hole arrived relatively late. In 1927 the National Academy of Sciences formed a committee to review the status of oceanography particularly in the United States. The committee recommended in 1929 that an institution devoted to oceanography be established on the east coast of the United States.

The Woods Hole Oceanographic Institution was founded in 1930; supported by an initial grant from the Rockefeller Foundation of two million dollars. A portion of this sum used for the construction of a laboratory building and the construction of the oceanographic research vessels Atlantis and Asterias. Additional funds were contributed by the Foundation for the support of the research program during the first ten years. Because of the direct practical value of many phases of oceanographic research, the Woods Hole Oceanographic Institution has received substantial assistance from the Office of Naval Research and other governmental agencies. In 1954 the Navy constructed an additional building for the Institution.

The WHOI has a year-round program of broad oceanographic research dealing with all aspects of the science. It has a fleet of half a dozen vessels that cruise all areas of the North and South Atlantic in a study of ocean currents, bottom topography, structure of the earth, composition of seawater, and the interrelations of biological phenomena in the sea.

Taken together, the three scientific institutions of Woods Hole, (Fisheries, MBL, and WHOI) present a broad front in the attack upon the mysteries of the sea. With its large fleet of vessels the Woods Hole Oceanographic Institution studies the general circulation of the Atlantic and the theories of oceanographic processes. The fisheries laboratory focuses on marine fishery problems, many of which can be solved only through a study of oceanographic conditions. The Marine Biological Laboratory uses marine materials for delving deeper into the revelation of the nature of life itself, and turns its attention to more local situations.

THE BUREAU OF COMMERCIAL FISHERIES PROGRAM IN FISHERIES OCEANOGRAPHY

The present Bureau of Commercial Fisheries derives its authority from the Fish and Wildlife Act of 1956 which provided for a Fish and Wildlife Service composed of two separate bureaus, a Bureau of Commercial Fisheries and a Bureau of Sport Fisheries and Wildlife. The Act charges the Bureau of Commercial Fisheries with many responsibilities relating to the development, protection and wise use of the resources of the sea.

Included in these responsibilities is the study of the resources in order to develop and recommend measures which are to assure the maximum sustainable production of fish and fishery products.

Since many saltwater fishermen sail hundreds of miles from home to procure their catches, the fishery resources with which the Bureau of Commercial Fisheries is concerned are found over large ageas of the oceans. Thus, in order to fulfill its obligations to the fishing industry and the American people, the Bureau has found it necessary to develop a number of research programs related to the high seas fisheries and oceanography over wide areas of the seas. These are conducted from 18 major research laboratories supported by 7 oceangoing research vessels.

The Pacific tuna program with staffs and vessels based in Hawaii and California extends over the tropical Pacific from California to areas well west and south of the Hawaiian Islands. To properly study the North Pacific salmon fishery biologists may be working anywhere on the high seas between Canada, Alaska, Japan, and Russia. The California sardine investigations take Bureau biologists and oceanographers to areas off the coasts of California and Mexico. In the Atlantic the important groundfish resources which have traditionally supported the New England fisheries require ocean studies between Cape Cod and Newfoundland. The great offshore shrimp fisheries of the South Atlantic States and the Gulf of Mexico are being studied from Galveston, Texas and St. Petersburg, Florida, with investigations ranging as far south as South America. The studies of the vast menhaden fisheries are centered at Beaufort, North Carolina, but the investigations range from Long Island to Texas. The Atlantic herring, known in the United States as the Maine sardine, receives attention at the Bureau's Laboratory in Boothbay Harbor, Maine. More recently the Bureau has turned its attention to the tropical Atlantic between Africa and the Americas in order to explore the tuna resource and to investigate oceanographic conditions in that area.

Since much of the marine fishery resources are in international waters the Bureau is obligated to conduct much of its work on an international basis. Any regulation of fishing on the high seas requires cooperation with other countries. Furthermore, research in these areas is greatly facilitated if planned and executed formally with other governments. As a result the Bureau's research is now concerned with nine international fishery commissions, and with other organizations such as the International Oceanographic Commission of UNESCO and the Special Committee on Oceanographic Research of the International Committee of Scientific Unions.

THE WOODS HOLE FISHERY LABORATORY'S PROGRAM TODAY

Although the methods and techniques in fishery science have changed, the objectives of the "fishery laboratory" today are the same as they were when Spencer F. Baird established this type of research in the last century: to increase our store of fundamental knowledge about the fish and fisheries of the sea so that exploitation may be both continuous and maximal; thus insuring a harvest for tomorrow as well as for today.

The present Laboratory program can be divided into two parts, (1) studies of the biology of population dynamics of important species with a view to management recommendations and (2) broad ecological and studies of the ocean waters in which these species live. Our work is concentrated on groundfish species, as other Laboratories along the coast direct their attention to pelagic fishes and inshore molluscs. There are specific programs conducted at Woods Hole for cod, haddock, silver hake, redfish, flounder, and sea scallop, while broader programs cover such subjects as oceanography, planktology, benthic organisms, groundfish ecology, physiology and fish behavior.

Limiting the fishing effort on a commercial marine species is extremely difficult to accomplish both from a technical and a sociological point of view. Methods which are used in inland sport fisheries, such as restricting the season of fishing or area fished, are not practical in a high-seas commercial fishery. The approach used to date has been to decrease the fishing pressure on the smaller sizes of fish while allowing full effort on the larger sizes. This has been accomplished by specifying large meshes in otter trawl nets, the standard type of gear used by United States commercial groundfish fishermen. To date only two species, cod and haddock, have been brought under minimum mesh size regulations as a result of research conducted in recent years at Woods Hole.

The marine fisheries beyond the three-mile limit are in international waters so that any regulation of fishing activity must be effected through international agreement. In the year 1950 the International Commission for the Northwest Atlantic Fisheries was brought into being for the "investigation, protection and conservation of the fishes of the Northwest Atlantic Ocean, in order to make possible the maintenance of a maximum sustained catch from these fisheries...." Thirteen nations with fishing interests in the convention area, which extends from Greenland to Rhode Island, are members of this Commission: Canada, Denmark, France, West Germany, Iceland, Italy, Norway, Poland, Portugal, Spain, USSR, United Kingdom and the United States of America. All fishery research conducted by member countries in the convention area is planned and reviewed annually by appropriate committees of the Commission. The Woods Hole Laboratory has the responsibility of fulfilling United States research committments.

Management measures today are concerned solely with regulating the fishing effort on the available stocks of fish. Nature does not provide a constant supply of fish much to the fisherman's discomfiture. Since the availability or abundance of fish fluctuates drastically from year to year, it is the responsibility of the fishery biologist to determine the factors of the environment which cause these variations in abundance. This requires a thorough knowledge of all aspects of the biology of the species and of the interrelation of the fish within this environment.

Developing this understanding requires a long range program of basic research . fishery biology and oceanography. Marine fishes produce eggs by the hundreds of billions, but most perish in the first month of existence, falling prey to disease, and predators, or they drift off to unfavorable environments carried by the vagaries of ocean currents.

The old method of hatching eggs in the laboratory and then returning them to the sea has not proven successful for pelagic fishes. A million larvae "planted" in the sea sounds impressive, but it is not a drop in the proverbial bucket when compared to the numbers nature herself produces each year in her attempt to maintain the species in a precarious world.

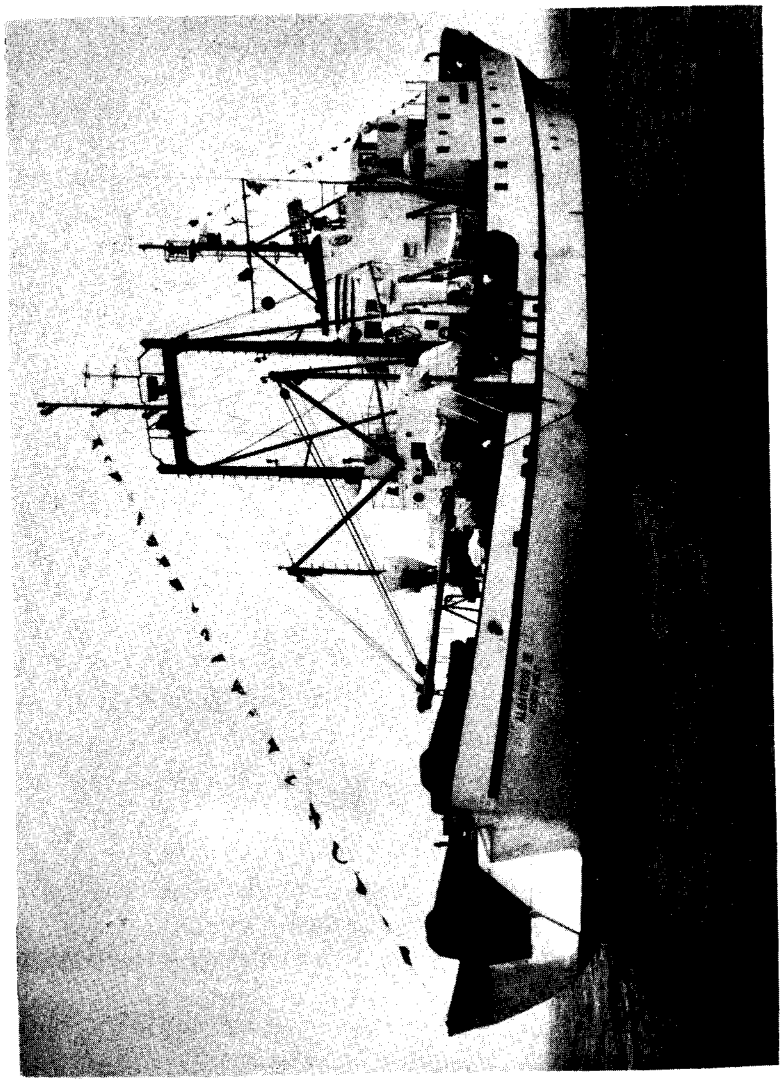
Our problem is to determine the normal fate of these billions of individuals, and to discover the conditions which are conducive to increased survival. There are so many aspects to a research program involving a study of the physical, chemical, and complex biological conditions of the sea that the scope of the investigators to have any hope of success, must necessarily be limited in geographic area. The Woods Hole Laboratory accordingly conducts its studies in the part of the ocean closest to home, namely, in the area between Nova Scotia and New York which includes the Gulf of Maine and Georges Banks.

What needs to be done now is to relate changes in the environmental conditions with changes in the fish populations. To accomplish this the Laboratory will embark this year upon an intensive series of oceanographic surveys in our area, extending over a five year period in order to build up the necessary data for such a study. A new vessel, the Albatross IV, is now being build, and will be placed in operation in October to carry out these studies.

The acquisition of this vessel, together with the new Laboratory buildings, will complete the replacement of all the old floating and shore facilities of the Woods Hole Fishery Laboratory.

United States
Department of the Interior
Stewart L. Udall, Secretary
Fish and Wildlife Service
Bureau of Commercial Fisheries

ALBATROSS IV



United States
Department of the Interior
Stewart L. Udall, Secretary
Frank P. Briggs, Assistant Secretary
Fish and Wildlife Service
Clarence F. Pautzke, Commissioner
Bureau of Commercial Fisheries
Donald L. McKernan, Director

ALBATROSS IV

Designed by

Dwight S. Simpson & Associates
Boston, Massachusetts

Built by

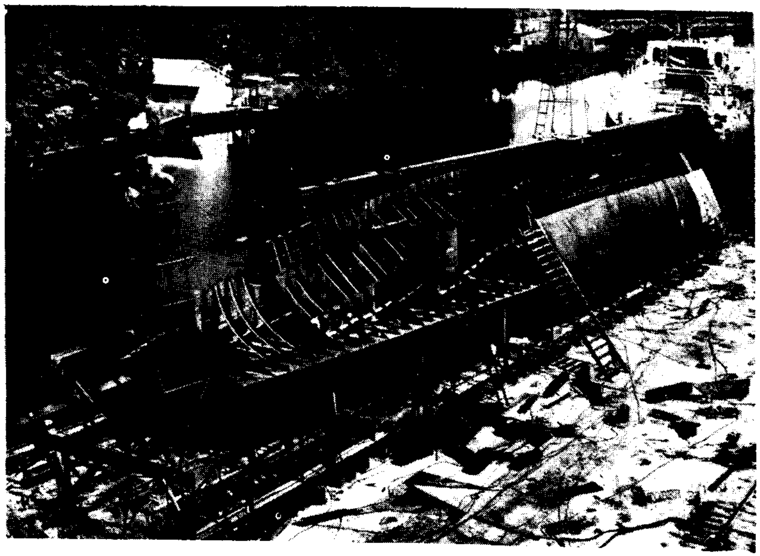
Southern Shipbuilding Corporation
Slidell, Louisiana

Laboratory Advisory Committee

Herbert W. Graham Laboratory Director
Robert L. Edwards Assistant Laboratory Director
Julius A. Posgay Fishery Biologist

Launched	April, 1962
Commissioned	May 9, 1963

The ALBATROSS IV



The Albatross IV is designed to conduct fisheries and oceanographic research in the Northwest Atlantic. She is especially equipped to collect information on the distribution and abundance of groundfish and sea scallops, and on the environmental factors which affect seasonal and long-term changes in the fish stocks. In addition, she is equipped to study the bottom organisms which form the food supply of groundfish, and to investigate plankton populations and oceanographic conditions generally.

Dwight S. Simpson & Associates, Marine Architects and Engineers of Boston, Massachusetts, designed the vessel to meet the operational requirements developed by the staff of the Bureau of Commercial Fisheries, Biological Laboratory, Woods Hole. Contract for the design was signed on February 23, 1960.

Contract to construct the vessel was given to the Southern Shipbuilding Corporation of Slidell, Louisiana in June 1961. Work on preparation of the working drawings, mold lofting and the shaping of frames and plates occupied most of that summer.

The erection of structural steel began in September of 1961. The laying of the keel is an event in the life of most ships that is second in importance only to the launching. Albatross IV, however, began life upside down and her keel was never "laid". It was installed more in the manner of the ridge pole of a house.

By November that part of the structure below the lower deck was complete and ready to be turned right side up. Three massive floating cranes performed this maneuver on November 4, 1961 before an admiring throng which served somewhat to compensate for the lack of a keel-laying ceremony. By the end of January, the steel hull up to the boat deck was complete and fabrication of the aluminum deckhouse began.

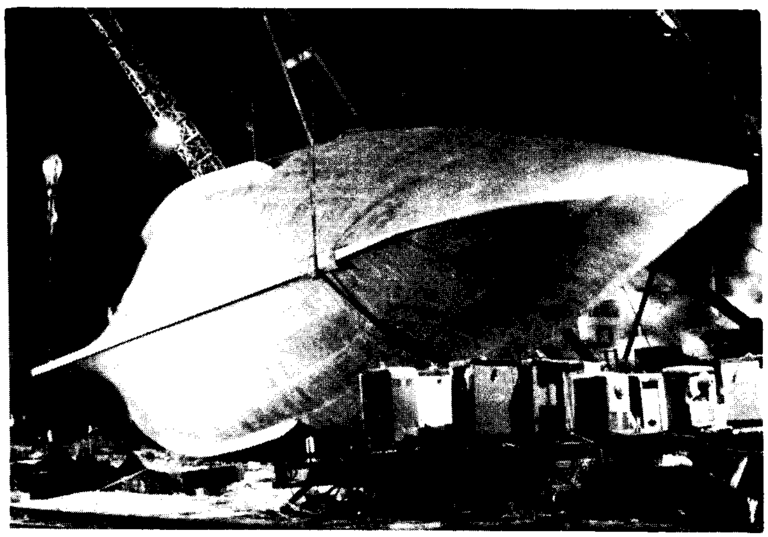
April 19, 1962 was a bright, sunny day in Louisiana, and promptly at 3:00 p.m. Albatross IV was launched into the Bayou Bonfouca. It was a perfect launching. The occasion was only marred by a leaking valve caused by a bit of debris which prevented it from closing fully. No damage was done and the leak was quickly stopped. The ship was completed in October 1962.

The vessel is designed for modern deep - sea fishery - oceanographic research. Special attention has been paid to provision of ample working space on the main deck; to the provision of adequate laboratory space for biological, chemical, and oceanographic work, and to the installation of special gear handling equipment and modern electronic devices.

The after part of the main deck is the main working area. Here is where all of the various kinds of gear will be lowered into the sea and recovered. There is a stern ramp for hauling nets and other gear aboard similar to that in use on many European stern trawlers. Sheaves for carrying trawl warps and other lines are suspended from a moveable gantry which can be rotated hydraulically 115° aft of the vertical and 90° forward and will lift 10,000 pounds. Its main function will be to handle the otter trawl, mid-water trawl, and heavy dredges.

The double drum main trawl winch is located on the lower deck. Each drum holds 6000 feet of 7/8-inch diameter cable with level winding gear which can be converted for other sizes of wire. The drum is driven through a reduction gear by a 125 h.p. electric motor to develop a stalled line pull of 30,000 pounds on both warps. From the winch the warps run forward to a pair of 20-inch sheaves on the deck. They then run up through the overhead to a pair of 20-inch sheaves on the main deck and aft to the towing blocks just inside the throat of the gantry. The warp from the dredging winch, with 4000 feet of 5/8-inch cable, is led in a similar manner along the mid-line of the vessel.

The sheaves on the main deck for the trawl and dredging winches are covered by a 36-inch high counter which also supports a vertical capstain and a small winch with 100 feet of 1/2-inch cable at each end.



The main boom is set on the mid-line of the ship at the forward end of the fishing deck. It will lift 10,000 pounds at a 34-foot radius and has two sets of falls, each with its own winch. At each mast there is a 24-foot steel pipe boom with powered falls and hand operated vangs. If desired, the wire from the hydrographic winches can be led to these booms.

At the after end of the boat deck, on the port side, there is an articulated hydraulic crane which can reach down to the water line, pick up a 1000-pound load and deposit it on either the main deck or the boat deck anywhere within a 13-foot radius of its base.

The control station for the main trawl winch, dredging winch, the main boom vangs, and the 2 falls winches on the boom is located at the after end of the boat deck just to starboard of the center line. From here, the winch operator has a clear view of the entire fishing deck.

There are 2 hydrographic winches on the after end of the boat deck each with a capacity of 20,000 feet of 1/4-inch wire. Collector rings are provided for 5 conductors. The control console is on the end of a 20-foot extension cable so that each winch can be operated either at the winch, at the rail, or on the main deck.

At 10 positions along the rail of the main deck there are brackets which will accept a utility davit, normally stowed below. Each of these davits is equipped with a small electric drum winch holding 300 feet of 1/4-inch wire rope and has a 1500-pound line pull. They are to be used for handling light gear at moderate depths

A watertight well, five by six feet wide, for servicing transducers runs from the main deck down to the bottom of the ship. On each side of the keel there is a hinged, water tight door to hold the sounding transducers. The transducers can be changed or serviced by putting a man in the well, pumping in air until sufficient pressure is created to prevent flooding, and then opening the lower doors.

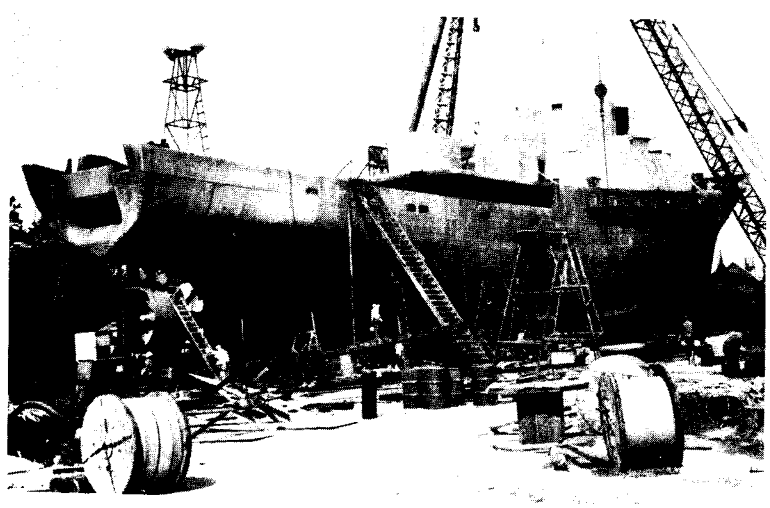
There is an instrument well in the wet laboratory and another in the hydrographic laboratory. These are three and a half feet square and, can be opened or closed by a diver or can be used to put divers in the water.

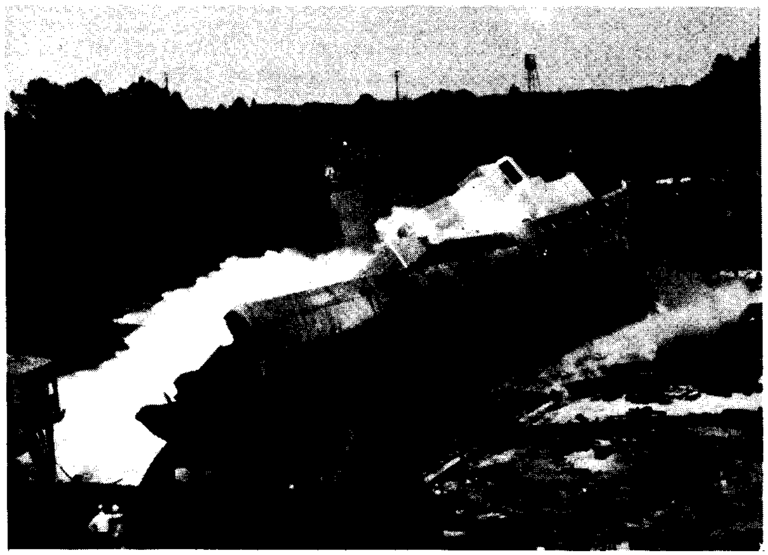
Provision is made for a 5-foot diameter fish well in the storage room. It is now part of the fuel oil tank system, but it can be made free-flooding by a minor alteration in the plating. It is anticipated that for the present, live fish will ordinarily be carried in portable tanks on deck or in the storage room supplied with sea water from the laboratory system.

Salt water is supplied to the wet laboratory, the rough laboratory, and the fishing deck by a non-corrosive, non-toxic system. The suction is located so that the entering sea water is not contaminated from any of the ship's discharges. Two hard rubber, 40-g.p.m. pumps discharge into a 60-gallon rubber-lined pressure tank. All piping and fittings are unplasticized polyvinyl chloride. All of the piping connections are made by gasketed flanges so that the system may be dismantled for cleaning. All branch lines end in a PVC valve so that the system may be easily extended for special purposes.

A major effort was made in the arrangement of the laboratory spaces to provide good communications between them as well as with the rest of the ship, but to keep them separate from the traffic of people engaged in other aspects of the ship's business. As little of the furniture and equipment as possible is permanently fastened to the ship's structure so as to permit easy rearrangement to meet the needs of the future.

Just forward of the fishing deck, open aft and on both sides, but sheltere by the house forward and the deck overhead, is a 32 foot by 10 foot area designeu for the preliminary processing of the collections. There is a bathythermograph winch with 2000 feet of 3/16-inch wire at each rail. Collector rings are provided for the use of conducting cable. The BT wire is led over a sheave in an A-frame pivoted outboard of the rail and topped by an electrically driven worm gear. A dumb-waiter communicates with the storage room on the lower deck and up to the boat deck.





Forward of the rough laboratory on the port side is the 13 foot by 33 foot wet laboratory which can be divided into two separate spaces by a moveable bulkhead. Facilities include a wet gear locker, dumb-waiter to decks below and above, three sinks, three salt water tables, work benches, overhead cabinets, refrigerator, and storage lockers. Every three feet along the permanent bulkheads are outlets for 110 volt alternating current, compressed air, cold salt water, hot fresh water, and cold fresh water.

Forward of the rough laboratory on the starboard side is a 10 foot square hydrographic laboratory for the immediate processing of water samples. It has Nansen bottle racks, storage cabinets, work bench, sink, and desk. Over the desk is an instrument panel giving time, ship's heading and speed, water depth, wind direction and velocity, air temperature, relative humidity, sea surface temperature, and barometric pressure. The indicating and recording unit for the telerecording bathythermograph is also visible from the desk.

Communicating with the hydrographic laboratory is a 7 foot by 13 foot space for chemical analysis. It has a sink, work bench, cabinets, freezer, salinometer, and spectrophotometer.

Forward of the chemistry laboratory, the dry laboratory, 15 feet by 11 feet, has a drafting table, two desks, a work table, cabinets, typewriter, and calculators. There is a fisherman's asdic and a 6000-foot sounder either of whose signals can be displayed on a precision graphic recorder.

A 5-foot by 6-foot photographic darkroom with all necessary furniture and equipment is just forward of the wet laboratory.

There is a 10-foot by 12-foot laboratory on the after part of the boat deck which is intended primarily for the monitoring, maintenance, and repair of specialized electronic equipment. It has work benches, cabinets, cable ports, 4 kinds of electric power, and a dumb-waiter communicating with the main and lower deck. Like all other laboratory spaces, it can be readily converted to other purposes.

The gyrocompass, radiotelephone, as well as power supplies and converters for the electronic equipment are housed in a room behind the pilot house on the starboard side.

About amidship on the starboard side there is a 13-foot by 13-foot study. It is comfortably furnished with 3 armchairs, a sofa, 4 straight chairs, a table, and bookcases.

The pilot house is about a third of the length of the ship from the bow one deck above the boat deck. It is completely equipped with modern controls and aids to navigation. The helmsman, looking forward, can see all necessary indicators and reach all controls. The officer on watch can go aft to a station just above t' winch operator and observe operations on the fishing deck. There is a direct tel phone connection from this station to the helmsman.

The chart room is just aft of the pilot house on the port side. The after part of the false stack is given over to a small duty cabin which can be converted to a radio room if a radioman is on board. Behind the electronics room, there is a space for the airconditioning unit and the emergency generator.

The after 50 feet of the lower deck is a single large compartment. Both outboard bulkheads are lined with bins for fishing gear and shelves and cabinets for sample containers. The trawl winch and dredging winch occupy the center of the room. Aft of the winches there is an elevator set under a flush hatch in the trawl deck to move heavy gear between the two decks. A walk-in refrigerator and a freezer are at the forward bulkhead.

The forward part of the main deck is occupied by berthing, toilet, and shower facilities for 16 crew men. Each of the eight rooms has 2 berths, 2 lockers, a settee, and a bureau. Berthing spaces for the master, chief scientist, mates, and engineers are on the boat deck where there is also a small office for the master.

Forward of the engine room are 6 cabins for scientists, one of which meets the requirements for a hospital room. Each cabin has 3 berths, lockers, bureau, and lavatory.

Forward of the uptakes on the port side there is a scientist's and officer's mess seating 14 and on the starboard side a crew's mess and lounge seating eight. The galley is forward on the starboard side. Meal service can be either cafeteria style through a hatch opening by the staircase or by mess boys. A dumb-waiter by the forward staircase is used to bring galley stores up from the lower deck or to carry them below from the forward weather deck.

Forward of the berthing area there is a laundry as well as space for frozen and refrigerated galley stores. Dry stores are on the deck below. The dumb-waiter serves the storage areas, the galley and the foredeck.

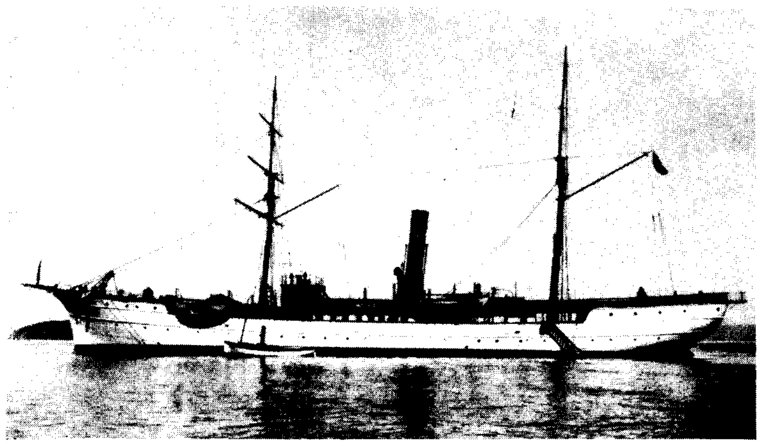
Two boats are carried, a 22-foot power launch and a 16-foot rowing wherry, both on mechanical boom davits operated by either power or hand. There are three 15-man inflatable covered life rafts stowed in Fiberglas containers.

One of the great problems of oceanographic research vessels is holding station and maintaining vertical wire angle. On this vessel this will be accomplished through the use of a controllable pitch propeller provided with a Kort type nozzle rudder and a bow thruster.

The bow thruster is a 36-inch, symmetrical propeller driven through bevel gears by a reversible 125-h. p. electric motor. It operates in a traverse, circular duct with its center about 7 feet below the water line and 9 feet from the stem. The increased maneuverability will be advantageous in docking and undocking as well as in station keeping.

Earlier ALBATROSS'S

The First ALBATROSS



The Albatross IV perpetuates an illustrious name among research vessels starting with the steamer Albatross of the United States Fish Commission. In the year 1881, at the suggestion of Commissioner Spencer Fullerton Baird, Congress authorized an appropriation totaling $148,000 for the construction of the vessel. Plans were drawn by Charles W. Copeland of New York and a contract for construction was awarded to Pusey & Jones of Wilmington, Delaware. The keel was laid in March 1882, the ship was launched in August, and she made her trial run on December 30.

"Thus began the long career of the United States Fish Commission steamer Albatross, the first vessel built especially for marine research by any government. During her forty years of service she surveyed the Newfoundland Banks, the Bering Sea, visited scattered archipelagoes of the Pacific, and served in two wars". (Hedgpeth, 1945, American Neptune, vol. 5).

The Albatross was an iron twin-screw vessel propelled by two independent two-cylinder steam engines designed by Mr. Copeland and built by Pusey and Jones. Each engine developed about 200 net shaft horsepower delivered independently to each of the screws which were nine feet in diameter and constructed of cast iron. Steam was generated by two coal stoked boilers which were placed fore and aft in the hold of the vessel. The vessel had a cruising speed of somewhat under 10 knots and consumed a little over 100 pounds of coal per mile at this speed.

The Albatross was also rigged as a brigantine and carried the following sails: mainsail, gaff-topsail, foresail, fore trysail, foretop-sail, foretop-gallant sail, fore staysail, jib and flying jib. Her total sail area was 7,521 square feet.

Her hull statistics were as follows:

Length over all	234 feet
Length at 12-foot water line	200 feet
Breadth of beam, moulded	27'6"
Depth from top of floor to top of deck beams	16'9"
Sheer forward	3'
Height of deck-house amidships	7'3"
Displacement on 12-foot water line	1,074 tons
Registered tonnage (net)	384 tons

The vessel was provided throughout with electric lights and, it is said that it was the first government vessel to be so equipped. The dynamo was designed by Mr. Edison who selected a particularly fine steam engine manufactured by Armington & Sims of Providence, Rhode Island to drive it. The dynamo generated 51 volts and a current for 120 lamps.

Edison electric lamps also were used for underwater observation of marine organisms at night and for attracting fish and other animals to night light stations. The deep-sea cable used for the light was 940 feet long.

The vessel was especially designed for dredging and the collection of bottom samples and animals at all depths. She had two well equipped large laboratories for the preservation and study of biological materials and the chemical analyses of water samples. One laboratory on the main deck was 14 feet long and occupied the entire width of the deck house. Another laboratory on the deck below was 20 feet long and equipped with a photographic darkroom and a chemical laboratory.

The Albatross carried five boats: a Herreshoff Steam Cutter, a steam gig, a seine boat, a whale boat and a dinghy. The 26 foot cutter seated 8 people, was powered with a 16 horse power steam engine, and could make 8 knots, but it was also provided with sliding gunter masts and sails, schooner rigged. Her bunkers held 1,000 pounds of coal.

The steam gig was 25 feet long, powered with 7-1/2 horse power engine and was generally lighter than the cutter. It had a speed of 7 knots and seated 7 persons. A peculiar feature of the boat was the location of the propeller under the bottom, about half the length from the stern. This prevented racing in heavy seas and made her performance in a sea-way remarkable.

The seine boat was designed especially for mackerel seining. It was 38 feet long, pulled eight oars and was schooner rigged with sliding gunter masts. The whale boat was 26 feet long, pulled six oars and was also schooner rigged with gunter masts. The dinghy was 18 feet long, pulled three pairs of sculls and was rigged with a split lug sail.

Since the Albatross was especially designed for deep sea dredging, her dredging equipment was one of its most interesting features. She carried 4,500 fathoms of 3/8 inch galvanized wire rope. The main dredging winch was on the main deck, but the wire was stored on a reel on the deck below. The wire rope from the dredge passed over the dredging block at the end of the dredging boom, then under a sheave in the heel of the boom, then upward and over a block suspended from a special rubber accumulator, and then to the central gypsy head of the main dredging winch.

After leaving the dredging winch the wire was passed below deck and lead under a governor, then to a leading block forward of the storage winch, and finally back to the reel of this winch. Through the action of the governor uniform tension was maintained on the rope, compensating for the surging on the dredging winch. A level wind distributed the rope evenly on the storage reel.

Deep soundings were made with a Sigsbee Sounding Machine powered by a Bacon one-cylinder steam engine. It could reel in the sounding wire at the rate of 100 fathoms per minute. A Tanner sounding machine was used in depths of less than 200 fathoms and for navigational purposes.

Subsurface samples of water were collected with a Sigsbee water bottle (then called a water-specimen cup) and an improved bottle invented by Kidder, Flint, and Tanner. Temperatures were taken with Negretti and Zambra deep-sea thermometers. Sea water densities were measured by Helgard's ocean salinometer.

The Albatross was built as a result of discoveries made by the Fish Commission vessel Fish Hawk in New England waters and the first five years of the Albatross' investigations were confined to the waters of the Atlantic Shelf from Cape Hatteras to Newfoundland. After the trial runs in the winter of 1882-1883 she made her first scientific cruise in the summer of 1883 from April to November, running from Washington to Woods Hole and return but investigating the fishes and bottom in a wide area of the coastal shelf and Gulf Stream. On this cruise she began amassing what was destined to become one of the greatest collections of marine organisms ever made by a single vessel. Innumerable publications have appeared based n the collections of this pioneer vessel.

From 1884 to 1887 she continued work in the Northwest Atlantic and in the Caribbean, making intensive dredging surveys and hydrographic stations. In March 1887 she was sent to the Pacific to investigate the fisheries of Alaska. She worked in these waters for three years investigating the fishery resources and fishing grounds of the Northeastern Pacific and Bering Sea, and in conducting hydrographic work. She was assigned particularly to the study of salmon, the Pribilof Islands seal herds and halibut.

In 1891 the Albatross made a special expedition to the tropical Pacific off the west coast of Mexico, Central America and the Galapagos Islands under the direction of Alexander Agassiz of Harvard University. Many of the collections of this and later cruises under Professor Agassiz' direction were deposited in the Museum of Comparative Zoology of Harvard University.

That same winter she surveyed the ocean bottom between San Francisco and Hawaii to determine the best route for a submarine telegraph cable to the Islands. For the next several years she was occupied with Alaskan fishery investigations including continued study of the Pribilof Islands fur seals; studying their pelagic life as well as the rookeries on the islands. She even became involved in enforcement work after the fur seals came under international regulations.

Interspersed with the Alaskan duties were numerous biological surveys conducted in various areas of the west coast of the Americas: a survey of San Diego Bay in 1894, Puget Sound salmon fisheries in 1896-1897, halibut surveys, and a systematic survey of all salmon streams in 1897.

In 1898, during the war with Spain, she was detailed to the Navy. Her dredging and collecting equipment was stored in Mare Island Navy Yard and alterations made to her deck house and bunkers.

The second Agassiz-Albatross expedition was conducted in 1899-1900. During this cruise the Albatross made collections over a wide area of the South Seas and Japan, adding enormously to our knowledge of the flora and fauna of the Pacific.

In the period 1900-1904, surveys were made along the West Coast, in Hawaii, and Mexico, under the direction of a number of scientists from Stanford University and the University of California, including David Starr Jordan, Barton Warren Evermann, Walter K. Fisher, Harold Heath, and C. A. Kofoid.

The third Agassiz expedition (1904-1905) took a number of scientists down the west coast of South America to Galapagos, Easter, and Gambier Islands.

In 1907-1910 the Albatross made her famous Philippine expedition which resulted in a wealth of information on the fishery and aquatic resources of these fascinating islands. This expedition was under the personal direction of Hugh M. Smith, Deputy Commissioner of Fisheries. F. M. Chamberlain was naturalist on board. Others in the scientific party included such well known biologists as H. C. Fasset, Lewis L. Radcliffe, Paul Bartch, Albert L. Barrows, Alvin Seale, and Roy Chapman Andrews.

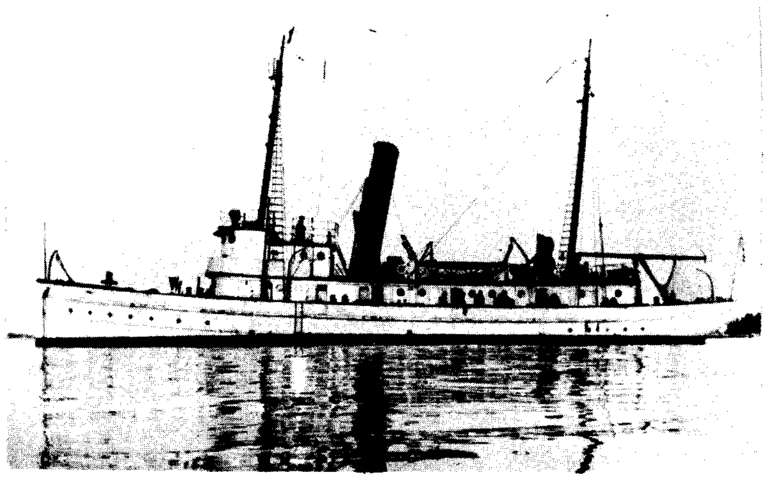
After this great expedition the vessel returned to Alaskan studies and surveys of the West Coast. During the year 1912-1914 she made an intensive survey of San Francisco Bay which resulted in a classical monograph of this area.

From then until the First World War she continued dredging and hydrographic surveys along the West Coast. During the war years, 1917-1919 she was placed under control of the Navy and transferred from the West Coast to Guantanamo, Cuba for patrol duty in the Caribbean and Gulf of Mexico.

After the war she returned to research in the North Atlantic, having been away for over 30 years. In 1919 she worked in the Gulf of Mexico in the environs of Cuba and off the South Atlantic coast. W. W. Welch was in charge with E. P. Rankin as ship's naturalist. In 1920 she surveyed the Gulf of Maine under the direction of Henry B. Bigelow, conducting hydrographic and biological investigations. This was the last scientific trip. In 1921 she returned to Woods Hole, the center of the Commission's research in the North Atlantic, where she was decommissioned on October 29.

The vast collections in the museums of this country, and the library of scientific papers that resulted from her cruises substantiate the fame this vessel acquired in all scientific circles of the world.

The ALBATROSS II



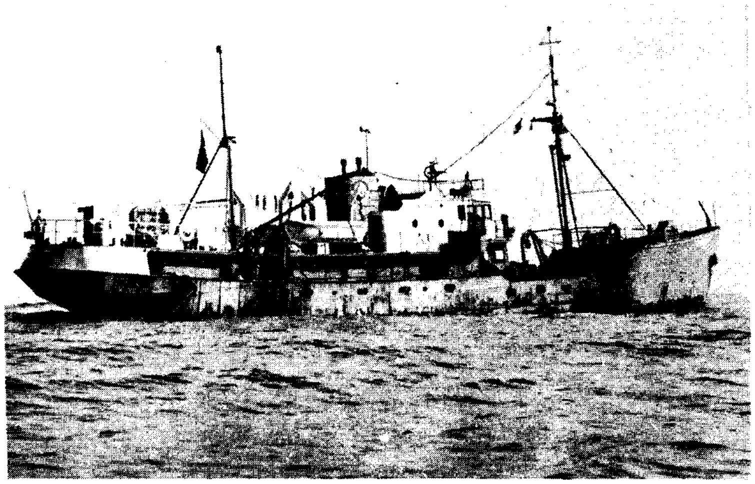
In 1926 the Bureau of Fisheries acquired from the Navy an obsolete sea tug, the Patuxent, for conversion to a fishery research vessel for work in the North Atlantic. This vessel which was built in 1909 was a two-masted steamer with steel hull. She weighed 521 gross tons, and an overall length of 150 feet, her header was 29 feet 6 inches and her draft 12 feet 3 inches.

The Bureau renamed her the Albatross II and used her in fishery research for six years. During the First World War she had been used as a minesweeper. By the time the Bureau received her she was so antiquated that operational funds were mostly consumed by costly repairs. She was taken out of service in 1932, and returned to the Navy in 1934.

During her years in marine research the Albatross II was used for surveying the New England fishing banks, and in studying the biology of some of the more valuable species. The important studies of haddock eggs and larvae by Walford, the studies of mackerel biology by Sette and plankton research by Bigelow and Sears were based, in part, on collections made by the Albatross II.

Herrington conducted experiments on the vessel which were designed to test the effectiveness of large mesh nets in permitting the escape of undersized fishes through the otter trawls. This work in "savings gear" laid the foundation for further experiments which ultimately led to the mesh regulations now in force for groundfish in the international fishing grounds of the Northwest Atlantic.

The ALBATROSS III



The Albatross III, like the Albatross II, was designed for other purposes and later converted for fishery research. The Albatross III, however, suffered a double conversion before she was put to the study of the sea.

Originally named the Harvard she was built in 1926 as a steam trawler and fished New England waters until 1939 when she was sold by the General Seafoods Corporation to the Government for $1.00 to be converted into a fisheries research vessel. In 1942, her conversion was well under way when she was taken over by the Coast Guard to be used for patrol duty; the Second World War was in full swing and vessels were badly needed. The Navy effected an extreme conversion by lengthening the vessel from 140 feet to 179 feet overall, removing trawling gear and adding armament and other military equipment. She was then renamed the Bellefonte.

Toward the end of the War (in 1944) the vessel was returned to the Fish ar Wildlife Service and once more was scheduled for conversion to a research vesse.. This was finally accomplished in 1948 and she was commissioned at the Boston Fish Pier on March 19 of that year.

As finally converted for research work the Albatross III resembled a Boston trawler although much longer than most of that fleet. She had an overall length of 179 feet, beam of 24 feet, and draft of 12 feet. Her displacement was 525 tons and cruising range 4,500 miles.

She was powered with a Fairbanks-Morse 7-cylinder, 805 horsepower diesel engine. Three diesel motor-generator sets generated 140 kilowatts of 110 volt DC power. The trawl winch was electric powered carrying 600 fathoms of 7/8 inch wire on each of its two drums, permitting trawling operations in 200 fathoms of water. The deck was fitted out in the fashion of the standard Boston trawler.

The Albatross III was originally provided with a fish hold to carry 50,000 pounds of fish on ice as in a commercial trawler. It was planned that fish caught in research operations would be landed and sold to the credit of the vessel, thus reducing the net cost of operation. After a few cruises this plan proved impractical and was abandoned. Two freezer units, however, proved more useful. One of these provided for quick freezing and maintained a temperature of 20° below zero, the other room held temperatures at about freezing. These were successfully used for the storage of scientific specimens, freezing replacing alcohol and formaldehyde as methods of preservation.

The laboratories were located on the main deck just aft of the trawl winch. The wet laboratory opened onto both the port and starboard decks through Dutch doors. It was fitted with a stainless steel sink in the center, suitable for handling and examining fish. Two small sinks located in the cabinets on the outside bulkheads were designed for chemical and hydrographic work. A dry laboratory or library, located aft of the wet laboratory, was provided with a large work table, chairs, bench, and shelves, and was used originally as an office for scientists for the preliminary study of data collected at sea. On later cruises it was crammed with electronic gear concerned with underwater television research.

Hydrographic booms and winches were located on the bridge deck on both the port and starboard sides. These booms featured travelers to which the lowering blocks were attached and which regulated the distance of the lowering wire from the rail.

Living quarters provided accommodations for the ship's crew and scientific personnel. The master's stateroom was located aft of the chart room on the bridge deck. The officers', mates', and engineer's rooms were located aft of the engine room on the main and lower decks. There were four scientists staterooms located around a wardroom on the lower deck forward of the galley and crew's mess. A stateroom for the steward and cook was located just forward of the crew's mess while the crew's quarters were in the forecastle on the lower deck. There were accommodations for a total of 35 men. Originally there was a crew of 21 men and a complement of 6 scientists, leaving 8 extra bunks available for additional scientific personnel or crew members as needed. The crew was later reduced to 18.

The Albatross III remained in the possession of the Government for eleven years, during which time she added materially to our knowledge of the fisheries and oceanography of the Northwest Atlantic. However, her usefulness to fishery research was impaired by a chronic shortage of operational funds.

She made her first scientific cruise on May 17, 1948. For the rest of that year and until September 1949, she worked fairly consistently surveying the New England Banks, conducting experiments on the selectivity of various sizes of mesh in otter trawls, and in hydrographic-plankton work. In 1950 she was able to operate only until September. Her financial difficulties were resolved in February 1951, when she was loaned to the Woods Hole Oceanographic Institution for work under an Office of Naval Research contract. In 1952 she was operated by the Fish and Wildlife Service under a similar contract. She returned to fishery research for the period March to September 1953, after which she was tied up at the Woods Hole dock until January 1955.

At this time new funds were obtained and the Albatross III was placed in continuous operation until March 1959. By this time increased maintenance costs of the ageing ship, and increased operational costs forced the Bureau to bring to a close the work of the third of the Albatross series. She was put up for sale under closed bids and sold to the Island Steamship Line, (Joseph T. Gelinas, President) of Hyannis, Massachusetts, in November 1959.

During her active life as a fishery - oceanographic research vessel, the Albatross III conducted 128 cruises in the waters off New England and in adjacent areas. She contributed greatly to the study of the wise utilization of the groundfish resources of the Northwest Atlantic. Much of her work related to the program of the International Commission for the Northwest Atlantic Fisheries which is concerned with the regulation of the fisheries in this area. These great fisheries are now under regulations imposed through the action of this Commission which is composed of thirteen countries with substantial interests in the area.

The work of the Albatross III has laid the foundation for a broader and more intensive program of investigation of the fisheries of this area developing the knowledge required for an intelligent approach to the management of the fisheries, and toward a better understanding of the relation of environmental conditions to the productivity of the area in terms of fishery resources.

SHIP'S GENERAL CHARACTERISTICS:

Length overall	187'0"
Length waterline	173'9"
Length B. P.	165'0"
Beam (moulded)	33'0"
Depth (moulded)	19'2-1/2"
Displacement tonnage	1000 tons
Draft (mean) Abt.	13'9"
Horsepower, main engines	1000-1100
Speed, designed	12 knots
Range at designed speed,	9000 nautical miles

Generators--Two, 150 kw. Diesel generators. 120/240 volt d. c.: one, 30 kw. emergency generator.

Fuel capacity	Abt. 182 tons
Fresh water capacity	Abt. 80 tons
Lube oil capacity	Abt. 3.5 tons

Accommodations:

Officers	6
Crew	16
Scientists	16

DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service Regional Information
GLOUCESTER, MASSACHUSETTS

BUREAU OF COMMERCIAL FISHERIES

For IMMEDIATE Release

FORECASTS OF GROUNDFISH AND SEA SCALLOP ABUNDANCE ON NEW ENGLAND BANKS

Changes in the abundance of groundfish on New England fishing banks are expected to be mixed during 1964, and the abundance of sea scallops will decline, according to Russell T. Norris, Acting Director of the North and Middle Atlantic Region of the Bureau of Commercial Fisheries. This forecast is based on information provided by biologists of the Bureau's Woods Hole Laboratory who monitor the landings of commercial fishermen, and study the population of fish and shellfish on offshore fishing banks by sampling with the Bureau's new fishing research vessel, Albatross IV.

Haddock landings in New England in 1963 will be approximately 112 million pounds, a decline from the 117 million pounds landed during the 1962 period. The stocks of haddock on New England banks are expected to remain in only fair supply during 1964 so landings in 1964 will not improve. The drop will be most noticeable in the scrod category because of the scarcity of small fish which has been due to the age groups spawned in 1960, 1961, and 1962 being below average in abundance.

more

However, things will be brighter in the haddock fishery after 1964. The survival of fish spawned in 1963 appears to have been unusually high. Both the summer and fall surveys of the offshore banks by the Albatross IV indicate the greatest abundance of young fish since the surveys were started in 1953. These young fish will reach marketable size and thus begin to be important to the fishery in the summer of 1965. This 1963 age group is expected to support the fishery for several years.

Landings of cod in 1963 will be slightly less than the high value of 35 million pounds landed in 1962. There has been an upward trend in cod landings during the past few years, and abundance in 1964 is expected to remain at a high level. Albatross IV surveys show a fairly strong age group spawned this year (1963) which should enter the fishery in late 1964 and early 1965.

Landings of redfish in 1963 will be somewhat over 100 million pounds with abundance holding steady. There is some indication that there will be more fishing in the Gulf of St. Lawrence in 1964. If so, total U. S. landings in 1964 will exceed those of 1963.

Yellowtail flounder landings in 1963 will be nearly 75 million pounds, an all time high. This is due to increased abundance of fish which resulted from excellent survival of the age groups spawned in 1958, 1959, and 1960. The oldest of these age groups will be of less

more

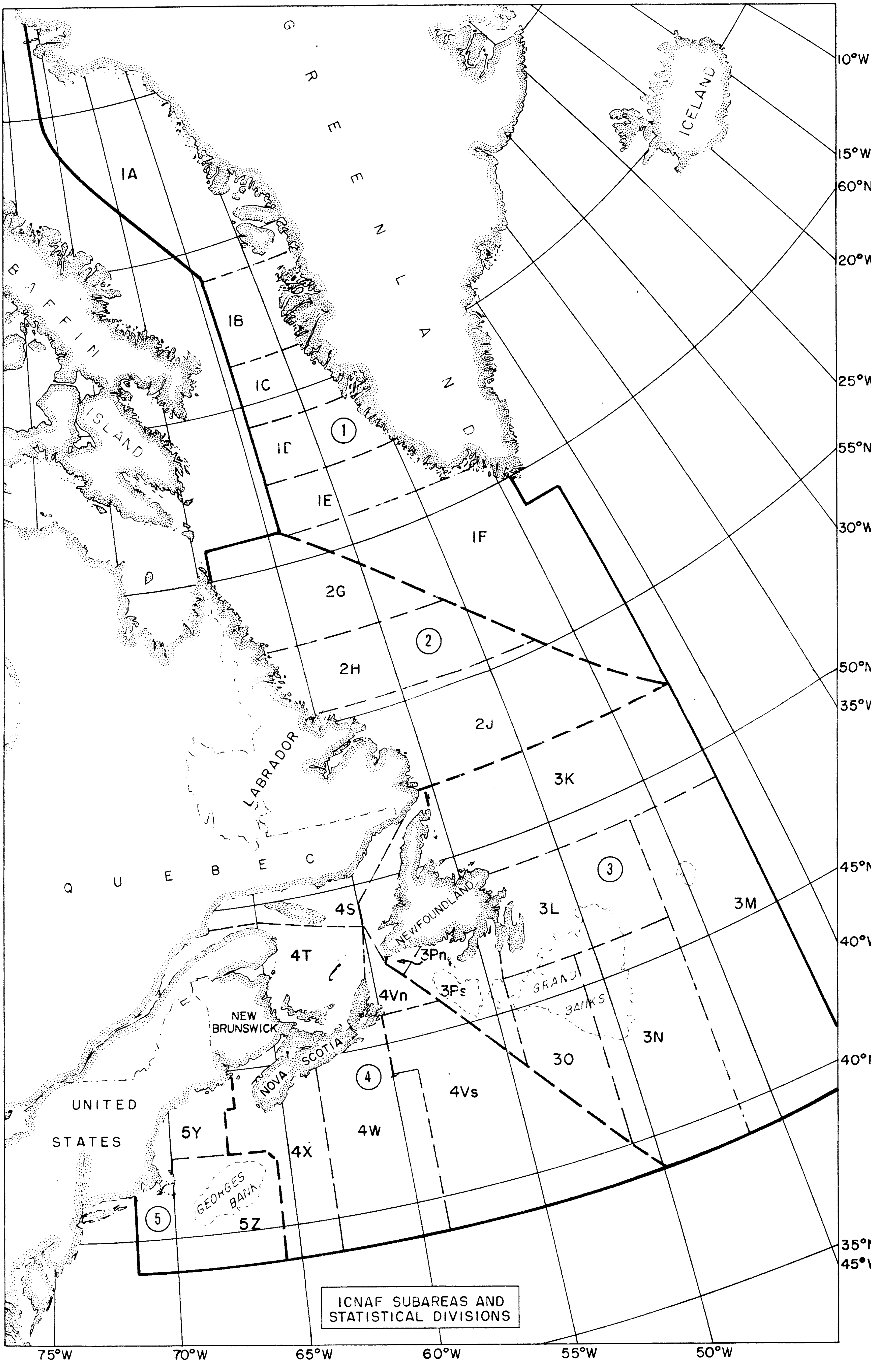
importance next year, and the following age group (1961) appears to be a poor one. Therefore, abundance and landings are expected to be lower in 1964, although still at a relatively high level.

United States landings of whiting (silver hake) will total about 92 million pounds which is slightly less than the figure for 1962. The U.S.S.R fleet probably removed an equal quantity of whiting from the area during the year. What effect the Russian fishing will have on the stocks of whiting cannot be determined at this time, according to the Woods Hole biologists. Thus they are withholding any estimate of the availability of this species to U.S. fishermen during the year 1964. There is, however, no indication at present of any serious decline in abundance.

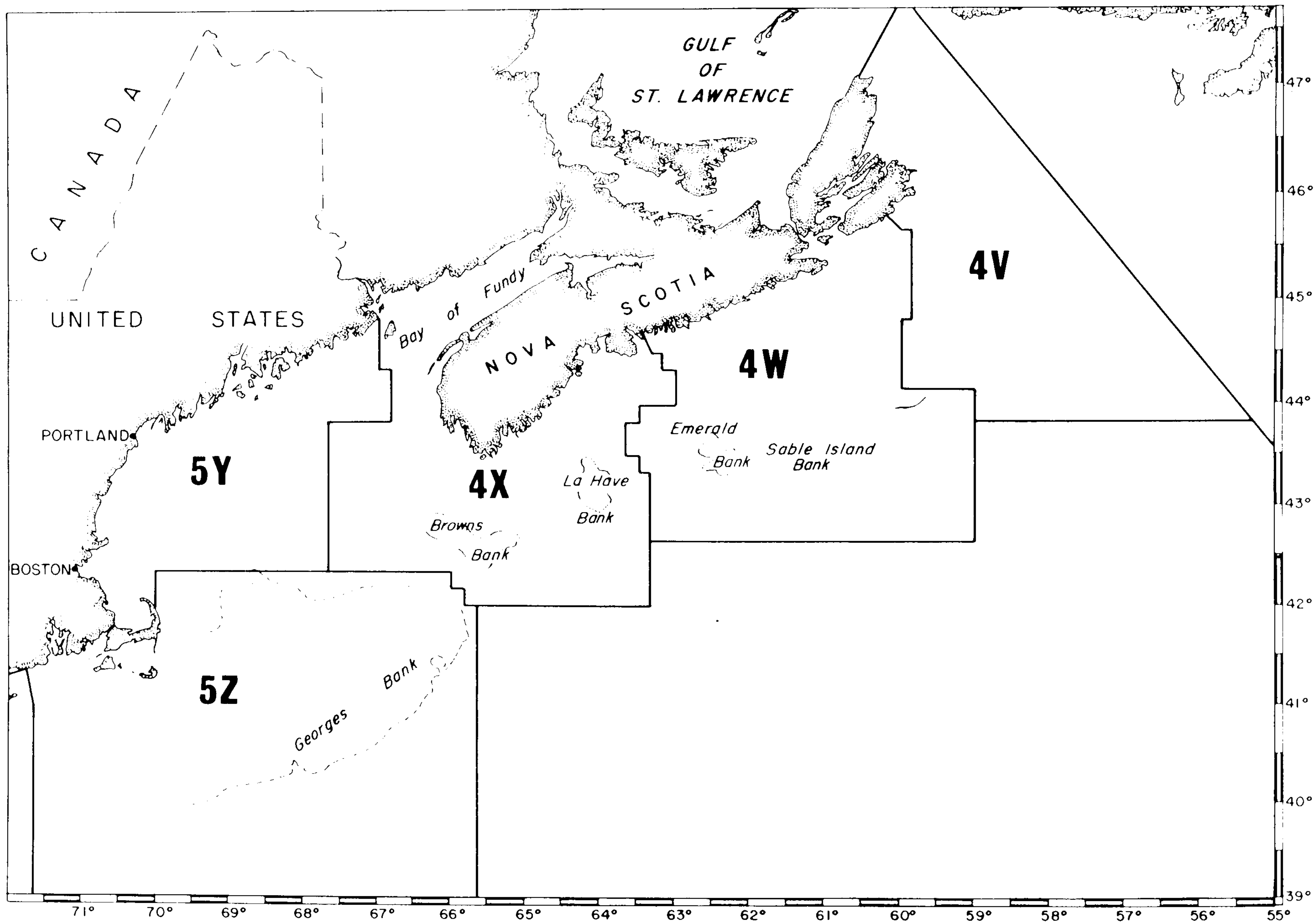
Sea scallops have suffered a decline in abundance during the past two years although total landings of U.S. and Canada did not slip much in 1963. United States vessels landed 19.7 million pounds which was 16 percent less than the 23.5 million pounds landed in 1962. Canadian landings, however, increased from 13.9 million pounds in 1962 to 16.4 million pounds in 1963. Research vessel surveys with the Albatross IV show that the downward trend in abundance is continuing so that we can expect landings to decrease again in 1964.

x x x x x

December 27, 1963



ICNAF SUBAREAS AND STATISTICAL DIVISIONS



GULF OF ST. LAWRENCE
CANADA
UNITED STATES
NOVA SCOTIA
Bay of Fundy
PORTLAND
BOSTON
4V
4W
4X
5Y
5Z
Emerald Bank
Sable Island Bank
La Have Bank
Browns Bank
Georges Bank
47°
46°
45°
44°
43°
42°
41°
40°
39°
71°
70°
69°
68°
67°
66°
65°
64°
63°
62°
61°
60°
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58°
57°
56°
55°

ICNAF Officers - 1963-1964

Chairman of Commission - Klaus Sunnanaa (Norway)
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Ageing Techniques - B. Rassmussen (Norway)
Herring - Bernard E. Skud (USA)

Stana CWP - Chairman Statistics Subcomm. - Hennemuth, (USA) and
Commission Statistician - C. DeBaie (Canada)

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal and Offshore Research	Aquarium	131.73

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		26,745	26,745
21. Travel and Transportation of Persons		200	200
22. Transportation of Things			
23. Rent, Communications & Utility Services		1,000	1,000
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		4,000	4,000
31. Equipment		800	800
Other			
Sub Total Program Direct Cost		32,745	32,745
Program Indirect Cost — 2/A		9,300	9,300
TOTAL OPERATING PROGRAM		42,045	42,045 42,000.

BREAKDOWN BY PROGRAM FEATURE

NOTED BY REGIONAL OFFICE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Exhibits and Displays		10,000	10,000
B	Culture of Marine Fish		20,000	20,000
C	Blueback		2,745	2,745
	Sub Total Program Direct Cost		32,745	32,745
	Program Indirect Cost — 2/A		9,300	9,300
	TOTAL OPERATING PROGRAM		42,045	42,045 42,000

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Herbert W. Graham Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63

30579

Personnel (name)	Grade	Cost
Wheeler	GS 11	9,769
Bailey	9	8,138
Ruschky	Uncl.	5,810
Matron	Uncl.	875
Summer Student Ass't	GS 3	1,036
Summer Student Ass't	4	1,117
Total personnel services		26,745

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase

Coastal and Offshore Research

No.	Title		1965	Increase	1964	1963	1962
		$	45.0	2.0	43.0	44.0	42.0
131	Aquarium	PP	3	0	3	3	3

Increase:

Need: Nominal increase required to cover increased costs of salaries and materials, and does not allow any expansion of program.

Additional positions: None

Program:

Objective: To provide facilities for the holding of various types of marine life for experimental purposes and to maintain in aquarium tanks for public display a representative group of fish and invertebrates of the Woods Hole region, and to provide a series of exhibits describing research in fishery biology and oceanography.

Accomplishments FY 1963: Success was achieved in holding a number of fish alive for one year, some for over two years, which provided biologists experimental material never before available.

The public part of the Aquarium was visited by more than 200,000 persons during the summer.

Base of Operation: Woods Hole, Massachusetts

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal and Offshore Research	Ass. of For. Fishing	131.97

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		36,129	36,129
21. Travel and Transportation of Persons		300	300
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		2,000	2,000
31. Equipment		1,700	1,700
Other			
Sub Total Program Direct Cost		40,129	40,129 40,1
Program Indirect Cost T/A Alb IV		16,000	16,000
		24,500	24,500
TOTAL OPERATING PROGRAM		80,629	80,629 80,6

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Assessment of Foreign Fishing		40,129	40,129
	Sub Total Program Direct Cost		40,129	40,129
	Program Indirect Cost T/A Alb IV		16,000	16,000
			24,500	24,500
	TOTAL OPERATING PROGRAM		80,629	80,629 80,6

NOTED BY REGIONAL OFFICE

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63.

Personnel (name)	Grade	Cost
Edwards	GS 13	12,970
Marek	11	9,646
Miller	11	8,966
Johnson	8	6,287
Total personal services		[illegible]

Briefing Statement
(In thousands of dollars)

Region #3

Program without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	80.6	82.6	79.0	--
131	Assessment of the Effect of Foreign Fishing	PP	4	4	4	--

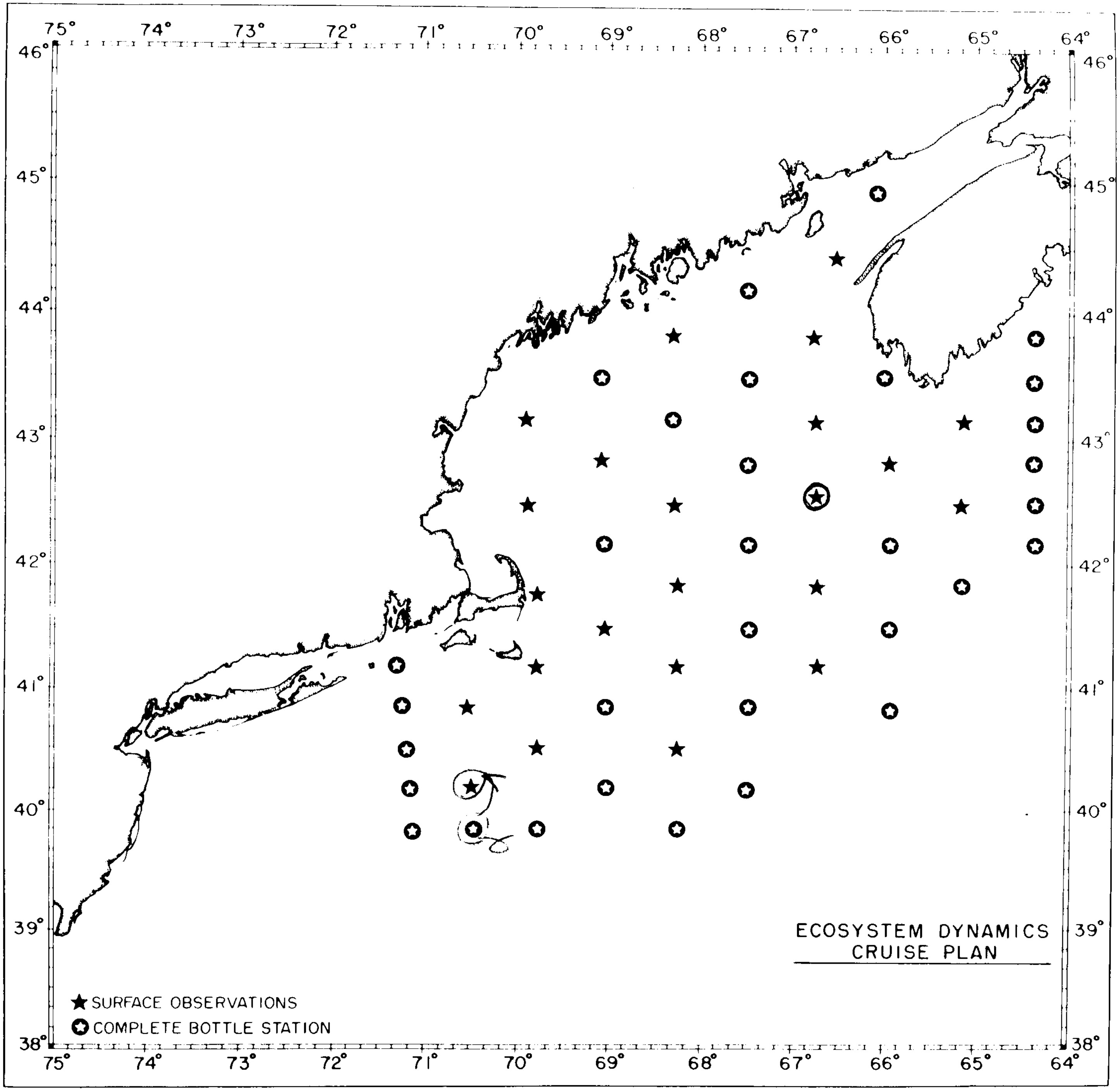
Program:

Work plan: Make intensive surveys of Georges Bank area with ALBATROSS IV to collect samples of both pelagic and bottom fish, and of the plankton and bottom invertebrates upon which these fishes subsist.

Objective: To determine the interrelationship of herring populations (which are fished by the Russians) and the groundfish (which are fished by the U. S. fleet) in an attempt to determine what effect depletion of the herring stock would have on the stocks of groundfish upon which the New England fishery depends.

Accomplishments FY 1963: A diurnal rhythm has been found in the feeding behavior of groundfish. This information will be used in estimating the total mass of food required by the groundfish populations.

Base of operations: Woods Hole, Massachusetts.



75° 74° 73° 72° 71° 70° 69° 68° 67° 66° 65° 64°
46° 45° 44° 43° 42° 41° 40° 39° 38°
ECOSYSTEM DYNAMICS
CRUISE PLAN
SURFACE OBSERVATIONS
COMPLETE BOTTLE STATION

Form 2-02 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 1, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal and Offshore Research	Benthos	131.35

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		30,415	30,415
21. Travel and Transportation of Persons		500	500
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		1,500	1,500
31. Equipment		1,000	1,000
Other			
Sub Total Program Direct Cost		33,415	33,415
Program Indirect Cost 2/4		8,000	8,000
Alb IV		40,400	40,400
TOTAL OPERATING PROGRAM		~~81,815~~	~~81,815~~ 81,800

BREAKDOWN BY PROGRAM FEATURE

NOTED BY REGIONAL OFFICE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Benthic Fauna		33,415	33,415
	Sub Total Program Direct Cost		33,415	33,415
	Program Indirect Cost 2/4		8,000	8,000
	Alb IV		40,400	40,400
	TOTAL OPERATING PROGRAM		~~81,815~~	~~81,815~~ 81,800

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63 Date

30579

Personnel (name)	Grade	Cost
Wigley	GS 12	11,268
Merrill	11	9,540
Theroux	7	6,461
Laboratory Assistant (WAE)		2,668
Total personal services		30,415

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	Increase	1964	1963	196
		$	86.0	2.0	84.0	84.0	75.
131	Benthos	PP	2	2	2	2	2

Increase:

Need: Nominal increase required to cover salary increases and increased material costs. No expansion.

Work plan: To complete the identifications and the analyses of samples already collected and to be collected during the year.

Objective: To facilitate the completion of the surveys and reporting of results.

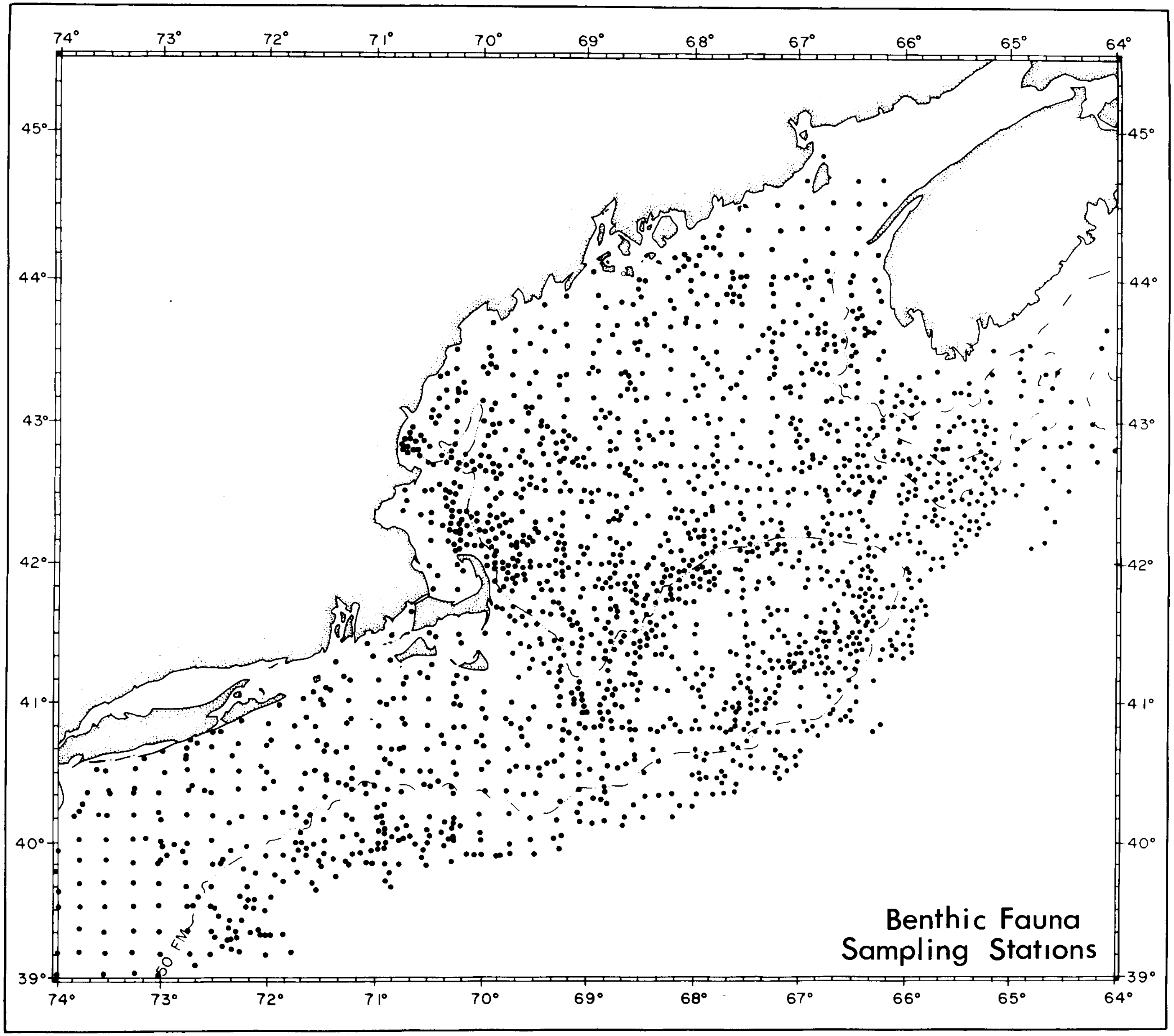
Additional positions: None.

Program:

Objective: To describe the bottom fauna of the Continental Shelf and determine its role in supporting the fisheries of the Northwest Atlantic.

Accomplishments FY 1963: An inventory of the larger bottom organisms in the northern and central Gulf of Maine was completed. Sampling in the area south of Marthas Vineyard and off Nantucket was completed. A special study of the microscopic bottom fauna in southern New England was completed. Over half of the samples of larger organ- isms from the southern New England area were analysed. Several special reports on animals found were published in scientific journals.

Base of Operations: Woods Hole, Massachusetts.


Benthic Fauna
Sampling Stations
50 FM
74° 73° 72° 71° 70° 69° 68° 67° 66° 65° 64°
45° 44° 43° 42° 41° 40° 39°

Review of Benthic Studies on New England Fishing Banks

Biological investigations by the newly organized U. S. Fish Commission during the 1870's and 1880's was, in part, devoted to studying the New England offshore benthic macrofauna. This early work, conducted by A. E. Verrill, S. I. Smith, O. Harger, W. H. Dall, H. A. Pilsbry, A. Agassiz and many other eminent Zoologists, was encouraged and guided by Spencer Baird and the Fish Commission. However, around the turn of the century these investigations went unsupported and were virtaully abandoned. As a result, our knowledge of the systematics of this fauna remains incomplete and zoogeographic and quantitative studies were not begun until the mid-twentieth century. Not only is there a lack of comprehensive macro-benthic studies, but only a few ecologically oriented reports are available concerning particular areas (Smith and Harger, 1874; Verrill, 1882a, 1882b, 1884; Agassiz, 1888).

From that era until the 1950's there were no significant benthological studies conducted in these offshore waters.

The Benthos Program was established at the BCF Biological Laboratory at Woods Hole because of the lack of appropriate knowledge of invertebrate predators, competitors, and food supplies relating to commercial groundfish stocks, and because of the inability to interpret groundfish food habit studies (Wigley 1956, 1962, 1963c) without general information about the kinds, quantities, and distribution of the food organisms.

The first quantitative study of New England offshore benthic fauna was undertaken by the Benthos Program in 1957 (Wigley, 1961a; Wigley and Theroux, Ms). Selected sections of the New England shelf are studied as time and facilities permit. In 1962 the scope of this Program was expanded by cooperating with the Woods Hole Oceanographic Institution - United States Geological Survey (WHOI-USGS) Atlantic Continental Shelf and Slope Study Program (Emery and Schlee, 1963). This cooperative arrangement is particularly beneficial because the WHOI-USGS group is primarily concerned with geological studies. We previously expended considerable effort studying bottom sediments (Wigley 1961c), whereas under the cooperative agreement we are furnished detailed sediment data both in the form of raw data and published reports.

In addition to the WHOI and USGS personnel, the Benthos Program is actively cooperating with 17 scientists from 12 universities or research laboratories. Most of these cooperating scientists are systemitists engaged in studying special groups of marine life. Other programs at this laboratory cooperate with the Benthos Program by providing qualitative and semi-quantitative benthic fauna samples that are incorporated into our studies (Wigley, 1960a).

Benthic components other than the macrofauna have received little attention. The meiobenthos in Gulf of Maine and contiguous waters is virtually unknown, except for the studies by Parker (1948, 1952) and Phleger (1952) pertaining only to foraminifera, and a general study by Wigley and McIntyre (Ms.).

Our immediate task is to complete the quantitative reconnaissance survey of the Continental Shelf, follow this with quantitative studies of seasonal or yearly changes of 5 or 10 key organisms, and eventually undertake detailed investigations (population dynamics) of one or more particularly important benthic communities.

Agassiz, A.
1888. Three cruises of the U.S. Coast and Geodetic Survey steamer Blake in the Gulf of Mexico, in the Caribbean Sea, and along the Atlantic Coast of the United States, from 1877-1880. Bull. Harvard Mus. Comp. Zool. 14: 1-314.

Emery, K. O. and John S. Schlee
1963. The Atlantic Continental Shelf and Slope, a program for study. Geol. Sur. Circular 481, 11 pp.

Parker, Francis L.
1948. Foraminifera on the Continental Shelf from the Gulf of Maine to Maryland. Bull. Mus. Comp. Zool., 100(2): 213-241.

Parker, Francis L.
1952. Foraminifera species off Portsmouth, New Hampshire. Bull. Mus. Comp. Zool., 106(9): 391-423.

Phleger, Fred B.
1952. Foraminifera ecology off Portsmouth, New Hampshire. Bull. Mus. Comp. Zool. 106(8): 315-390.

Smith, S. I. and O. Harger
1874. Report on the dredgings in the region of St. George's Banks in 1872. Trans. Conn. Acad. Arts and Sci. 3(1): 1-57.

Verrill, A. E.
1882a. Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, No. 3. Amer. Jour. Sci. 23: 135-142.

Verrill, A. E.
1882b. Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, No. 5. Amer. Journ. Sci. 23: 309-316.

Verrill, A. E.
1884. Notice of the remarkable marine fauna occupying the outer banks off Southern New England, No. 9. Amer. Jour. Sci. 28: 213-220.

Wigley, Roland L.
1956. Food habits of Georges Bank haddock. U. S. Fish and Wildlife Service, Spec. Sci. Rept: - Fisheries, No. 165, 26 pp.

Wigley, Roland L.
1960a. Note on the distribution of Pandalidae (Crustacea, Decapoda) in New England waters. Ecology 41(3): 564-570.

Wigley, Roland L.
1960b. A new species of Chiridotea (Crustacea: Isopoda) from New England waters. Biol. Bull. 119(1): 153-160.

Wigley, Roland L.
1961a. Benthic fauna of Georges Bank. Trans. North Amer. Wildl. and Nat. Res. Conf. 26: 310-317.

Wigley, Roland L.
1961b. A new isopod, Chiridotea nigrescens, from Cape Cod, Massachusetts. Crustaceana 2(4): 286-292.

Wigley, Roland L.
1961c. Bottom sediments of Georges Bank. Jour. Sedimentary Petrology, 31(2): 165-188.

Wigley, Roland L.
1963a. Pogonophora on the New England Continental Slope. Science, 141 (3578): 358-359.

Wigley, Roland L.
1963b. Occurrence of Praunus flexuosus (O. F. Müller) (Mysidacea) in New England waters. Crustaceana 6(2): 143.

Wigley, Roland L.
1963c. Density-dependent food relationships with reference to New England groundfish. Ms.

Wigley, Roland L. and A. D. McIntyre
1963. Some quantitative comparisons of offshore meiobenthos and macrobenthos south of Martha's Vineyard. Ms.

Wigley, Roland L. and Roger B. Theroux
1962. Quantitative reconnaissance survey of the Georges Bank Benthic fauna. Ms.

Wigley, Roland L. and Roger B. Theroux
1962. Food habits of Highlands Ground haddock. Ms.

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal and Offshore Research	Cod	131.33

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		16,165	16,165
21. Travel and Transportation of Persons		100	100
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		300	300
31. Equipment		600	600
Other			
Sub Total — Program Direct Cost — F/A		17,165	17,165
Program Indirect Cost — X15 IV		6,500	6,500
TOTAL OPERATING PROGRAM		23,100 ~~18,765~~	23,100 ~~18,765~~

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Migrations and Definitions of Stocks		8,582.50	8,582.50
B	Age and Growth		8,582.50	8,582.50
	Sub Total — Program Direct Cost — F/A		17,165.00	17,165.00
	Program Indirect Cost — X15 IV		6,500.00	6,500.00
	TOTAL OPERATING PROGRAM		23,100.00 ~~18,765.00~~	23,100.00 ~~18,765.00~~

NOTED BY REGIONAL OFFICE

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name ______ Title ______ Date ______

Approved By: Herbert W. Graham Laboratory Director 7/19/63 Date

Personnel (name)	Grade	Cost
Jensen, Al	GS 11	9,500
Murray	6	6,665
Total personal services		16,165

Briefing Statement
(In thousands of dollars)

Region #3

Coastal and Offshore Research

Program without Increase

(Subactivity)

No.	Title		1965	1964	1963	1962
		$	46.8	50.0	49.0	49.5
131	Cod	PP	2	2	2	2

Program:

Work plan: Collection of blood samples, scales, and otoliths and subsequent study and analysis from the four principle stocks of cod in the area between Nova Scotia and New Jersey. Determination of distinctness of stocks and growth rates.

Objective: To obtain biological information regarding cod stocks in the New England area which is essential to the management of the fishery.

Accomplishments FY 1963: Blood samples were collected from a number of stocks for stock identification. Growth rates indicate no appreciable change from rates determined 30 years ago. Information valuable to assessment of effects of fishing.

Base of operations: Woods Hole, Massachusetts

Cod Program - Review of Past Work

by A. C. Jensen

The world landings of cod (<u>Gadus morhua</u>) in the North Atlantic are on the order of 8 billion pounds per year (Wise, 1961) clearly making it the most important fish in these waters. Because of its importance as a food fish, and with a history of exploitation that antedates the written record, a vast body of literature has been built on the subject of the cod. A synopsis of cod biology prepared by Wise (1961) attempted to present the more important biological details in outline form. A listing of selected references complemented the biological data. An exhaustive bibliography published recently (Wise, 1963a) lists more than 1000 references on cod biology and represents an invaluable tool for the researcher interested in the species.

In the United States, the early cod studies leaned heavily on European experience but soon, distinctly American contributions were being added to the literature. Much of the work was concerned with seeking pragmatic solutions to what appeared to be a very real problem. How can man achieve the maximum, long-term benefit from the marine resource? (The problem basically is the same nearly a century later.) One solution seemed to be to stock the oceans with young cod and other fishes raised in hatcheries at Gloucester and Woods Hole. Thus, Earll (1880), at Gloucester, reported not only the production of eggs and larvae but also the fecundity and maturity, condition factor and length-weight relationships, food and feeding habits, and predators of the cod in local Massachusetts waters.

At the Woods Hole laboratory, cod larvae liberated in Eel Pond in 1899 grew a total of 4 centimeters during April-June (Smith, 1902). The first cod tagging experiment on the American coast was reported by Smith (1902) who tagged brood cod at the Woods Hole hatchery. The emphasis, however, was directed toward hatchery work.

The question of the fate of naturally spawned and hatched cod larvae was examined by Fish (1928). He used plankton nets and drift bottles to determine that fry from north of Cape Ann in Massachusetts Bay are carried out before they hatch, perhaps eventually to the offshore banks.

Schroeder (1930) tagged nearly 25,000 adult cod on Nantucket Shoals in the summer. The recaptured fish (3 percent) were from the Cape Cod - Nantucket area in the summer and as far away as New Jersey in the winter.

Following Schroeder's work, little cod biological research took place in Woods Hole until the 1950's. Bigelow and Schroeder (1953) revised an earlier work and summarized our knowledge of the species in the Gulf of Maine. The cod program was reactivated in 1955 with the emphasis again on migrations but also differentiation of stocks (Wise, 1958b, 1959). Some confusion about the correct scientific name of the cod was removed by Cohen (1959) who, supplied with information from the Woods Hole laboratory, reported it to be *G. morhua*. A literature review (Wise, 1958c) critically examined the effect of hydrographic conditions on the important aspects of the species' life history.

Parasites of cod were investigated (Wise, 1958a) including one that gave evidence of being a natural tag (Sherman and Wise, 1961). An overview of cod stocks in the Northwest Atlantic (Wise and Jensen, 1960) was later incorporated into a more detailed paper by Templeman (1962). Finally, the accumulated evidence of the previous studies was supplemented by returns (Wise, in press) from nearly three thousand tagged cod to separate four cod groups in New England waters (Wise, 1963b).

Recent research in cod biology is directed toward age and growth problems and techniques for their solution. Schroeder (1930) had back-calculated lengths from cod scales collected during his tagging experiments. These data were used in a theoretical study by Taylor (1958) who suggested that the maximum size and life span of cod might be affected considerably by slight changes in water temperature.

Otoliths and scales were examined from cod kept in aquaria (Jensen, ms. 1962a) and from cod in the open ocean. Growth zones in the otoliths (Jensen, ms. 1962b) are more clearly defined than those in the scales (Jensen, ms. 1963).

The goal of our research today is the same as it was in the late 19th Century - to gain the maximum benefit from the ocean resources. But we have added the conservationist's maxim of wise use. Some of the old ways of harvest (Jensen and Brigham, 1963) for example, helped to perpetuate the cod fishery. Our studies today must work toward making modern methods of harvest compatible with the avowed goal of wise use.

Cod Biology Review

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__________ and Robert K. Brigham

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______________ and Albert C. Jensen
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Form ~~2-102~~ (Rev. July 1963) Q-1

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin: Woods Hole, Massachusetts	Region or Area: Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title): 131 Coastal and Offshore Research	Program Title: Experimental Studies	Program No.: 131.37

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		14,434	14,434
21. Travel and Transportation of Persons		200	200
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		2,000	2,000
31. Equipment		800	800
Other			
Sub Total — Program Direct Cost		17,434	17,434
Program Indirect Cost — F/A / XIB IV		8,900 / 24,400	8,900 / 24,400
TOTAL OPERATING PROGRAM		50,734	50,734 50,700

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
1	Experimental Studies		17,434	17,434
	Sub Total — Program Direct Cost		17,434	17,434
	Program Indirect Cost — F/A / XIB IV		8,900 / 24,400	8,900 / 24,400
	TOTAL OPERATING PROGRAM		50,734	50,734 50,700

NOTED BY REGIONAL OFFICE

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name [illegible signature] Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63 Date

Personnel (name)	Grade	Cost
Cumming	GS 9	7,913
Lawday	7	6,521
Total personal services		14,434

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	55.0	3.0	52.0	45.0	50.1
131	Experimental Studies	PP	2	0	2	2	2

Increase:

Need: This modest increase is required to cover salary increases and special equipment for electrophoresis.

Additional positions: None.

Program:

Objective: To use blood characteristics for the determination of the discreteness of stocks of offshore groundfish.

Accomplishments FY 1963: A blood serum bank was established. Storage methods were developed. Techniques were developed which can be used to distinguish different groups of groundfish in the New England area.

Base of operations: Woods Hole, Massachusetts.

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal and Offshore Research	Flounder	131.18

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		9,426	9,426 9404
21. Travel and Transportation of Persons		500	500
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		3,000	3,000
31. Equipment		1,500	1,500
Other			
Sub Total Program Direct Cost		14,426	14,426 14,404
Program Indirect Cost — X/A		18,100	18,100
Alb IV		25,000	25,000
TOTAL OPERATING PROGRAM		57,526	57,526 57,504

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Yellowtail Biology		9,616	9,616 9,600
B	Blackback Biology		4,810	4,810 4,804
	Sub Total Program Direct Cost		14,426	14,426 14,404
	Program Indirect Cost — X/A		18,100	18,100
	Alb IV		25,000	25,000
	TOTAL OPERATING PROGRAM		57,526	57,526 57,504

NOTED BY REGIONAL OFFICE

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: [signature] Name Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63 Date

30579

Personnel (name)	Grade	Cost
Lux	GS 11	9,426
Total personal services		9,426

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase

Coastal and Offshore Research

No.	Title		1965	Increase	1964	1963	1962
		$	99.0	40.0	59.0	61.0	55.0
131	Flounder	PP	2	0	2	3	3

Increase:

Need: Several cruises of the ALBATROSS IV are required to collect the necessary samples.

Work plan: Collect samples from Georges Bank in each season. Collect samples inshore in the winter. Search for immatures.

Objective: To determine the relation of the inshore blackback to the offshore lemon sole which belong to the same species. Determination of the amount of mixing of these two populations is basic to an assessment of the effects of any proposed mesh regulations.

Additional positions: None.

Program:

Objective: To obtain biological information regarding the flounder stocks in the New England area which is essential to the management of the fishery. The species concerned are yellowtail flounder, blackback flounder, and fluke.

Accomplishments FY 1963: A report was completed on the relationship of fishing effort to the abundance of yellowtail flounder. A record of the changing age composition of yellowtail stocks was obtained for a 15 year period. A large tagging program for fluke was initiated.

Base of operations: Woods Hole, Massachusetts.

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal and Offshore Research	Groundfish Ecology	131.56

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		39,202	39,202
21. Travel and Transportation of Persons		1,000	1,000
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		2,000	2,000
31. Equipment		3,000	3,000
Other			
Sub Total Program Direct Cost		45,202	45,202
T/A		34,000	34,000
Program Indirect Cost Alb IV		28,000	28,000
TOTAL OPERATING PROGRAM		107,202	107,202

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Distribution & Abundance of Groundfish		27,601	27,602
B	Study of Survey Techniques		27,601	27,601
	Sub Total Program Direct Cost		45,202	45,202
	T/A		34,000	34,000
	Program Indirect Cost Alb IV		28,000	28,000
	TOTAL OPERATING PROGRAM		107,202	107,202

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name [signature] Title Date

Approved By: Herbert W. Graham Laboratory Director Title 7/19/63 Date

30579

Personnel (name)	Grade	Cost
Fritz	GS 11	8,4[illegible]
Livingstone	11	[illegible]
Nickerson	7	7,[illegible]
Burns	4	4,[illegible]
Russell	3	4,[illegible]
Fitzgerald	3	[illegible]
Total personal services		[illegible]

Equipment List

B-T s & Hansen Bottles	2,000

Briefing Statement
(In thousands of dollars)

Region #3

Programs with Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	113.0	3.0	110.0	115.0	110.0
131	Groundfish Ecology	FP	5	0	5	5	5

Increase:

Need: Nominal increase to apply toward salary increases and increased materials costs. No expansion of program.

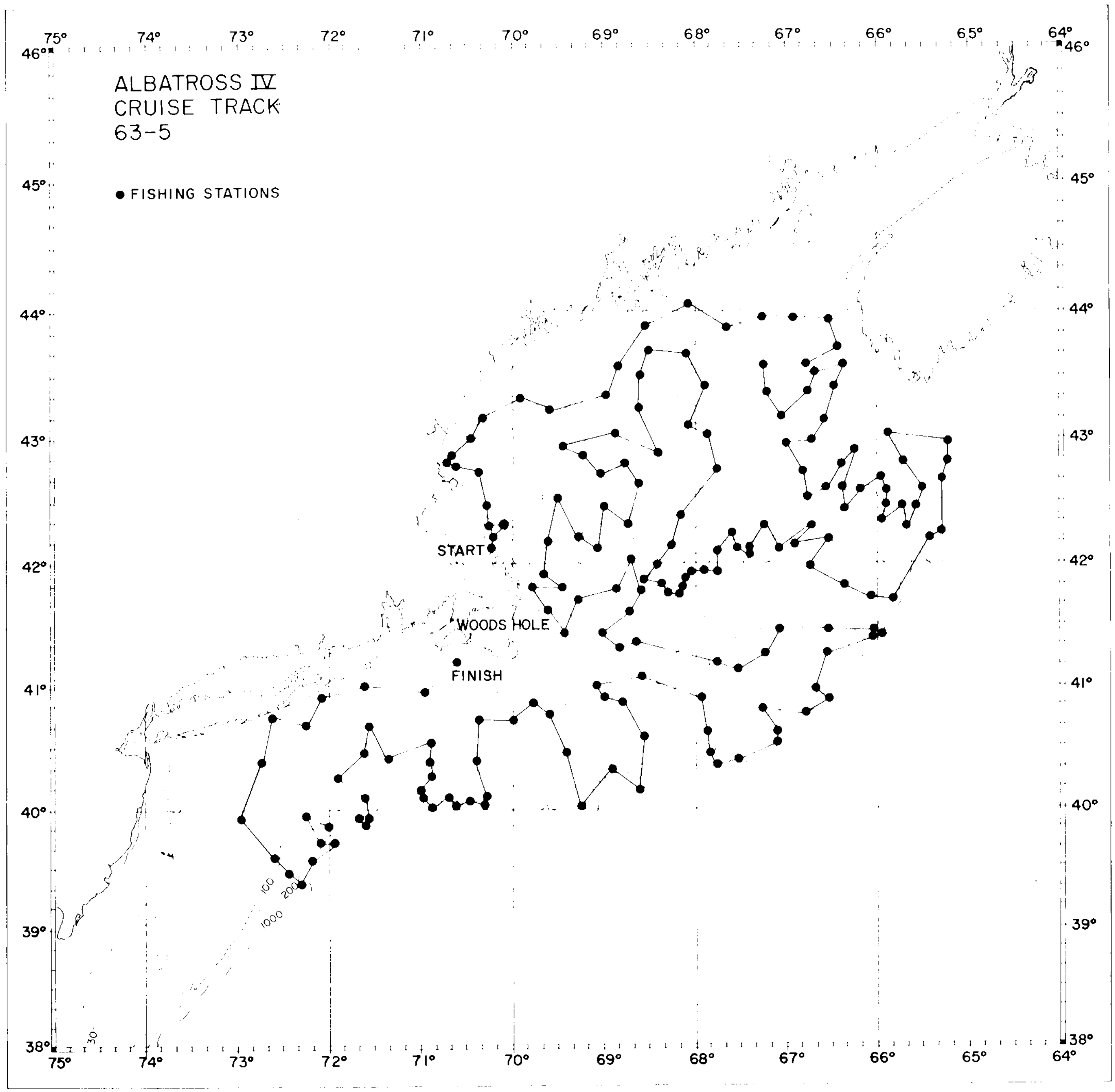
Additional positions: None

Program:

Objective: To determine the environmental conditions that control the distribution, abundance, and availability of groundfish in the Northwest Atlantic.

Accomplishments FY 1963: Analysis of ~~port~~ past data back to 1949 completed. Distribution charts and temperature charts in press.

Base of operations: Woods Hole, Massachusetts.


ALBATROSS IV
CRUISE TRACK
63-5
● FISHING STATIONS
START
WOODS HOLE
FINISH
75°
74°
73°
72°
71°
70°
69°
68°
67°
66°
65°
64°
46°
45°
44°
43°
42°
41°
40°
39°
38°
100
200
1000
30

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

Revision #1

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
131 Coastal and Offshore Research	Haddock	131.34

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)	22,929		22,929
21. Travel and Transportation of Persons	300		300
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials	1,000		1,000
31. Equipment	700		700
Other			
Sub Total — Program Direct Cost	24,929		24,929
Program Indirect Cost — T/A Alb IV	8,000		8,000
TOTAL OPERATING PROGRAM	27,500 60,429	+3,300	30,800 63,729

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Biology of Haddock	24,929		24,929
	Sub Total — Program Direct Cost	24,929		24,929
	Program Indirect Cost — T/A Alb IV	8,000		8,000
	TOTAL OPERATING PROGRAM	~~27,500~~ 60,429	~~+3,300~~	30,800 63,729

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Herbert W. Graham — Laboratory Director — 10/28/[illegible]

Approved By:

Name — Title — Date

30579

Personnel (name)	Grade	Cost
Grosslein	GS11	9,402
McDermott	9	7,665
Hersey	5	5,862
Total personal services		22,929

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	65.0	3.0	62.0	61.0	60.6
131	Haddock	PP	3	0	3	3	3

Increase:

Need: Nominal increase will be used to apply against salary increases and increased cost of supplies.

Additional positions: None.

Program:

Objective: To study the biology of the Northwest Atlantic haddock which is one of the important species now managed under international mesh regulation. The biological studies are necessary to evaluate the effect of regulations.

Accomplishments FY 1963: A special study of the effects of errors in reading scales and otoliths was completed. A Canadian - United States study of the population structure of the Browns Bank haddock was completed.

Base of Operations: Woods Hole, Massachusetts

REVIEW OF LITERATURE ON HADDOCK IN THE NORTHWEST ATLANTIC

I. Distribution of the species

On the basis of differences in age and length compositions of landings, growth rates, seasonal variations in fisheries and tagging studies, Needler (1930a) concluded there were three major population groups of haddock in the Northwest Atlantic--New England, Nova Scotian, and Newfoundland. The distribution of returns from haddock tagged off the coast of Maine, Schroeder (1942), and differences in growth rate between Georges and Browns Bank, Schuck and Arnold (1951), Wise (1957), add confirmation to this division. In a preliminary study Vladykov (1935) reported differences in average vertebral numbers among haddock from the three regions. In a more intensive study Clark and Vladykov (1960) confirmed the differences in vertebral numbers for the three regions and also concluded that the Nova Scotian population could be further subdivided into three subpopulations (western, central, and eastern). Grosslein (1962) reported on a summary by various ICNAF investigators of current knowledge of haddock stocks in the convention area. It was concluded that there are at least three stocks in Newfoundland waters (western Newfoundland, St. Pierre Bank, Grand Bank), two distinct stocks in Nova Scotian waters (eastern and western Nova Scotia separated by the Scotian Gulf), and tentatively three more or less separate adult groups in New England waters (Bay of Fundy and northern Gulf of Maine, inshore waters near Cape Cod, and offshore waters on Georges Bank).

II. History of the U. S. haddock fishery

From 1880 to the early 1900's U. S. haddock landings were fairly stable with average annual landings at about 54 million pounds (Needler, 1930b; Herrington, 1941; unpub. ms.; Power, 1958). In this period haddock were caught chiefly by hand line and later by line trawls, particularly on western parts of Georges Bank (Rich, 1930).

Steam trawlers appeared in the early 1900's and offshore fishing effort increased (Alexander, Moore, and Kendall, 1915; Rich, 1930). The catch rose steadily with increase in the number of trawlers, and U. S. fishermen landed an average of 77 million pounds from 1904-1918 (Power, 1958). Prior to 1921 most haddock were marketed fresh, but thereafter the industry began filleting and packaging haddock for sale throughout all New England; and in 1926 quick freezing appeared and haddock sales became nationwide. U. S. landings rapidly increased from approximately 90 million pounds in 1921 to a peak of 294 million in 1929, the bulk of this harvest coming from Georges Bank. From 1929 to 1934, haddock abundance and fishing effort both declined substantially resulting in a drastic decline in U. S. landings (Schuck, 1951; Graham, 1952; Taylor, 1958). From 1934-1941 there was an upward trend in both landings and abundance on Georges Bank, and during the 1940's average annual haddock landings from Georges Bank have been about 100 million pounds (Graham, 1952). Since 1950 Georges Bank landings have averaged about 83 million pounds a year and abundance has been at a level somewhat below that of the 1940's (unpublished data, U. S. Fish and Wildlife Service).

The precipitous decline of landings and abundance on Georges immediately following the peak in 1929 aroused concern in the industry for conservation of the stock, and led to the establishment of a haddock investigation by the U. S. Bureau of Fisheries. Systematic collection of detailed landings statistics and age and length samples have been obtained since 1931. The development of statistical procedures for recording catch and effort, and sampling landings, were described by Rounsefell (1948 and 1957). Schuck (1951) gave a detailed description of haddock landings by season and subdivision for Georges Bank during the period 1931-48, including estimated numbers and pounds of haddock at each size landed in each market category. Length frequency and scale samples collected from Georges Bank and Gulf of Maine haddock landings since 1931 were published by McCann and Dreger (1963) and the age-length composition of the 1956 U. S. haddock landings from New England have been described (Clark and Dreyer, 1961).

The seasonal and geographic distribution of fishing effort for haddock by the U. S. otter-trawl fleet was described (Schuck, 1952).

At the beginning of the U. S. haddock investigation attention was focused on the extent of destruction of young haddock (too small for market) by the otter trawlers, and means of preventing this destruction (Herrington, 1933, 1935, 1936, 1941, and 1944; Schuck, 1947; Royce and Schuck, 1950; Premetz, 1953, and 1954). Clark (1952) reported on mesh selection experiments by the Woods Hole laboratory and subsequently a minimum mesh size of 4 1/2 inches was recommended for otter trawlers fishing haddock stocks in ICNAF subarea 5 (Graham, 1952). The recommendation was adopted in 1953 and the apparent effects of the first year of mesh regulation was described (Graham and Premetz, 1955). A more recent evaluation of the mesh regulation was reported by an ICNAF working group on fishery assessment (Anon., 1962), based on more recent information on mesh selection (Clark, McCracken, and Templeman, 1958). At the present time it appears that further increase in mesh size would result in slight if any gain in yield per recruit from subarea 5 haddock stocks.

III. General life history

Fecundity

Earll (1880) examined ovaries from a small sample of haddock taken off the coast of Massachusetts. The haddock were from 48 to 71 cm. long and the egg counts ranged from 169,000 to 1,840,000.

Maturation

From observations on Georges Bank haddock taken in the spring, Clark (1959) reported that nearly half of 2-year-old males were mature, and all males were mature at age 3. About 80 percent of 3-year-old females were mature, but only the larger fish of this age group ($\geq$ 37 cm.). All males and females age 4 and older were mature.

Haddock on Browns Bank and adjacent inshore waters mature about one year older than on Georges Bank (Clark, 1959; Kahler, 1960).

Spawning

From knowledge of the location of concentrations of spawning fish obtained from commercial fishermen, and from knowledge of regions where newly spawned gadoid eggs were abundant, it has long been known that haddock spawn at various places along the coastal belt from Cape Cod to the entrance of the Bay of Fundy, but chiefly on Georges and Browns Banks (Bigelow and Welsh, 1925; Bigelow and Schroeder, 1953). Walford (1938) conducted extensive egg surveys in 1931 and 1932 on Georges Bank, and found that peak spawning occurred in February and March, and that the largest spawning concentrations were located on eastern parts of the bank. More recent egg and larval surveys in New England waters have confirmed that eastern Georges Bank and Browns Bank are the major haddock spawning centers, and that peak spawning occurs in February-March on Georges, and in April on Browns (Marak and Colton, 1961; Marak, Colton, and Foster, 1962; and Marak, et al., 1962). In these more recent surveys the Hardy continuous plankton recorder was used in order to obtain synoptic coverage of the entire Gulf of Maine, in an attempt to follow egg and larval drift as well as delineate spawning centers. The efficiency of the recorder as a survey instrument was evaluated by Colton and Marak (1962).

Information on development of eggs and larvae of haddock was reported by Walford (1938), Bigelow and Schroeder (1953), and Marak and Colton (1961).

Food habits

Analysis of haddock stomach contents in New England waters has revealed in every case that rather small, sedentary invertebrates form the major portion of the diet (Clapp, 1912; Homans and Needler, 1944; Bigelow and Schroeder, 1953; Wigley, 1956). In Wigley's study the percentage volume of each major food group was as follows:

Group	% Volume
Crustacea	33
Mollusca	18
Echinodermata	15
Annelida	10
Pisces	2

Examination of stomachs from larval haddock taken in spring surveys in four different years in the Gulf of Maine revealed that adults and juveniles of four species of copepods, and larval copepods represented the major portion of the diet (Marak, 1960).

Behavior

Seasonal movements of haddock on Georges Bank have been inferred from the regular seasonal fluctuations in abundance on certain parts of the Bank (Schuck, 1951). The most notable example is the concentration of spawners on the northeastern parts of Georges Bank and to a lesser extent in the south channel during winter and early spring. Also Colton (1955) found differences between the spring and summer distribution of haddock on Georges according to age and depth. The older haddock tend to move into deeper water with vernal warming.

The tendency for haddock to aggregate in schools was clearly demonstrated by analysis of the frequency distributions of otter-trawl catches of haddock (Taylor, 1953).

Clark (1958a) observed behavior of haddock inside an otter trawl by means of underwater television gear, and concluded that chafing gear did not inhibit escapement of fish from the cod end. Livingstone (1962) also observed haddock in the cod end of a trawl and from their behavior suggested that fish attempted to keep pace with the trawl (a visual response) and appeared not to make any active attempt to escape.

The vertical distribution of haddock larvae on Georges Bank was investigated with high speed multi-depth samplers, and it was found that larvae tend to be concentrated in the upper 20-30 meters (Miller, Colton, and Marak, 1963). Furthermore periodic fluctuations in larval depth distribution were correlated with vertical changes in the thermocline; about 80 percent of the larvae captured were taken within confines of the thermocline.

Growth

Several studies have been conducted to determine the validity of age readings obtained from haddock scales and otoliths. The consistency of scale reading for Georges Bank haddock was reviewed by Clark (1958b) and the time of formation of annuli on haddock scales determined (Jensen and Clark, 1958). Comparisons of age readings from scales and otoliths were reported by Kohler and Clark, 1958. Finally evidence for validity of age readings from scales of Georges Bank haddock was put forward by Jensen and Wise, 1962. Graham (1952) summarized information on growth rate of Georges Bank haddock and noted that it was greater than for haddock in any other waters.

Comparisons of length at age for haddock on Georges and Browns Banks indicated that the haddock of the latter area had significantly slower growth (Schuck and Arnold, 1951). Back-calculated body lengths based on a body-scale relation for Browns Bank fish, also showed slower growth than that reported for Georges Bank (Wise, 1957).

Clark and Dietsch, 1959, summarized length-weight data for haddock in the northwest Atlantic.

Taylor, Jensen, and Stoddard (1959) examined variations in growth rate of Georges Bank haddock during the period 1953-1958, and concluded that these variations were too small to account for observed increases in average weight of landed fish.

Mortality

Schuck (1949) reported a significant correlation between estimated decreases in stock and removals in the Georges Bank haddock fishery for the period 1931-47, which indicated that natural mortality probably was low. Taylor (1958) attempted to estimate natural mortality rate from a regression of fishing intensity on abundance at age; data based on ages 4-5, and 5-6 provided two estimates of natural mortality near zero which tended to confirm Schuck's conclusion.

Annual total mortality for Georges Bank haddock, 1931-48, was estimated to be 45 percent (Graham, 1952).

IV. Environmental factors affecting haddock populations

Recruitment

From egg and larval surveys with the Hardy plankton recorder, and from analysis of drift bottle returns and the drift of surface buoys, Colton and Temple (1961) concluded that surface drift on Georges Bank was predominantly offshore during the haddock spawning season (February-April), and that under average conditions eggs and larvae would be carried away from Georges Bank.

Chase (1955) obtained a significant negative correlation between haddock brood strength and an index of offshore wind on Georges Bank during the spawning season for the period 1928-1951.

Adult population

The decline of the haddock fishery on Nantucket Shoals in the 1920's and concurrent changes in other fisheries has been related to the general climatic warming in this region (Taylor, Bigelow and Graham, 1957; Royce, Buller, and Premetz, 1959).

Herrington (1948) reported that during the period 1912-30 minimum recruitment of young haddock to the fishery occurred at the lowest and highest levels of adult stock suggesting a density-dependent relation between spawning stock and recruitment. At high levels of adult stock Herrington suggested that competition for food between yearling and adult haddock was the cause for lower recruitment. When moderate stock levels in the 1940's failed to produce the expected increases in recruitment Herrington suggested that overall food supply may have declined.

V. Miscellaneous

Rounsefell (1942) conducted field experiments with three tag types (Petersen disc, opercle; bachelor button, opercle; internal anchor) and obtained returns of 13-21 percent, with the Petersen disc yielding the highest return. Jensen (1958) demonstrated the superior corrosion resistance of stainless steel to nickel pins on tagged haddock held in aquaria. Also Jensen recorded the nature of damage to the fish caused by tags.

Royce and Schuck (1954) developed a multiple linear regression formula based on catch of major age groups and on past and predicted fishing effort, which permitted forecasts of haddock landings from Georges Bank one year in advance.

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Form 2-102 (Rev. July 1963)

U-1

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
431 Coastal and Offshore Research	Hake	431.74

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		39,976	~~39,976~~ 40,000.
21. Travel and Transportation of Persons		200	200
22. Transportation of Things			
23. Rent, Communications & Utility Services IBM		6,000	6,000
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		1,600	1,600
31. Equipment		1,000	1,000
Other			
Sub Total Program Direct Cost		48,776	~~48,776~~ 48,800.
Program Indirect Cost			
TOTAL OPERATING PROGRAM		48,776	~~48,776~~ 48,800.

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Age Reading		12,194	~~12,194~~ 12,400.
B	Biostatistics		36,582	~~36,582~~ 36,400.
	Sub Total Program Direct Cost		48,776	~~48,776~~ 48,800.
	Program Indirect Cost			
	TOTAL OPERATING PROGRAM		48,776	~~48,776~~ 48,800.

NOTED BY REGIONAL OFFICE

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name [signature] Title Date

Approved By: Name Herbert W. Graham Title Laboratory Director Date 7/19/63

30579

Personnel (name)	Grade	Cost
McCann	GS 11	9,549
Nichy	8	7,483
Handy	9	8,037
Thompson	4	5,101
Cory	3	5,120
Newell	4	4,686
Total personal services		39,976

Briefing Statement
(In thousands of dollars)

Region #3

Program Without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	50.0	50.0	47.0	45.0
431	Hake	PP	6	6	6	6

Program:

Work plan: To develop age reading techniques, establish growth rates and mortality rates of silver hake and delineate the seasonal migrations.

Objective: To obtain the biological information necessary for the management of the silver hake fishery.

Accomplishments FY 1963: Length-weight keys were completed. A growth rate was determined for the principal stock.

Base of operations: Woods Hole, Massachusetts.

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	40.0	40.0	--	--	--
131	Hake	PP	0	0	0	0	0

Increase:

Need: This program has been supported by S-K funds, but an increase is needed to meet our committments to the scientific committee of ICNAF. Silver Hake is being heavily fished by the Russians off Cape Cod, and a mesh regulation covering it is being considered. More biological information is needed.

Work plan: Research vessel surveys and an intensive collecting program in the areas of the fishery.

Objective: To provide the information essential to the management of the Silver Hake (Whiting) fishery in New England.

Additional positions: None.

Program:

Objective: To provide the biological information essential to the management of the Silver Hake (Whiting) fishery in New England.

Accomplishments FY 1963: Length-weight keys were completed. A growth rate was determined for the principle stocks.

Base of operations: Woods Hole, Massachusetts.

V-1

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
431 Coastal and Offshore Research	Oceanography	431.8

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)			
21. Travel and Transportation of Persons			
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services — Contract		28,000.00	28,000.00
26. Supplies and Materials			
31. Equipment			
Other			
Sub Total Program Direct Cost		28,000.00	28,000.00
Program Indirect Cost			
TOTAL OPERATING PROGRAM		28,000.00	28,000.00

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Woods Hole Oceanographic Institution Contract		28,000.00	28,000.00
	Sub Total Program Direct Cost		28,000.00	28,000.00
	Program Indirect Cost			
	TOTAL OPERATING PROGRAM		28,000.00	28,000.00

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Title Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63

Name Title Date

30579

Briefing Statement
(In thousands of dollars)

Region #3

Program Without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	28.0	28.0	28.0	28.0
431	Oceanography	PP	0	0	0	0

Program:

Work plan: Contract with Woods Hole Oceanographic Institution.

Objective: To study the meteorological and hydrographic conditions that might relate to the changing abundance of fishes in the Northwest Atlantic.

Accomplishments FY 1963: Observation posts at lightships were maintained and the annual reports of temperature and salinity published. Drift bottles and sea bed drifters were released throughout the area Cape Hatteras to Nova Scotia. Analysis of surface currents made.

Base of operations: Woods Hole, Massachusetts.

Briefing Statement
(In thousands of dollars)

Region #3

Coastal and Offshore Research
(Subactivity)

Program with Increase

No.	Title		1965	Increase	1964	1963	1962
		$	28.6	28.6	- -	- -	- -
131	Oceanography	FP	1	1	- -	- -	- -

Increase:

Need: Until this year S-K funds have supported a contract with the Woods Hole Oceanographic Institution to maintain coastal oceanographic observation posts and study ocean currents. Additional funds are required to make offshore observations with the ALBATROSS IV, and analyze the results on a sustained basis.

Work plan: Surveys with the ALBATROSS IV and the placement of recording devices.

Objective: To provide the environmental information required to understand the fluctuations in abundance and availability of groundfish in the New England area.

Additional positions: One GS-13 oceanographer.

Program:

Objective: To understand the relationship between oceanographic conditions and the groundfishes of the Northwest Atlantic.

Accomplishments FY 1963: Under S-K funds observations posts at lightships were maintained and the annual report of temperature conditions and salinities were published. Surface current observations were made by means of drift bottles.

Base of operations: Woods Hole, Massachusetts.

Review of Whiting Research

The first full year of the whiting project was in 1955. Immediately a study was started to determine the different stocks of whiting present. Morphometric studies indicated that the southern New England, New York, and New Jersey whiting could be separated from the fish in the Gulf of Maine, Conover et. al. (1961).

Investigations were conducted to develop a successful tagging method. Fritz (1959) reported that whiting were very difficult to obtain in good condition for tagging. Even with considerable effort to minimize the effect of capture by trawls, only one-third of the fish were judged to be in a condition suitable for tagging. Nevertheless, a modified plastic tube tag did show returns of 5%, 8% and 9% in three experiments.

Observations were reported on the food habits (Jensen and Fritz, 1960). Fish and shrimp supplied the bulk of the diet. A larger study, still unpublished by Dr. Ralph V. Dexter of Kent State University, corroborated the findings of this Laboratory. An abstract of this study (Dexter, 1962) is published.

Mesh selection studies reported by Clark (in press) and Clark and Fritz (in press), as well as studies completed since then, show a very dull selection curve for whiting. Whiting were shown to escape in great numbers through the forward part of the net.

The history of the fishery was reported by Fritz (1960). Since 1930 the annual landings have increased more than ten-fold. In addition the method of fishing has changed from pound nets and float traps to otter trawls.

A general review of our knowledge of the whiting was published by Fritz (1962). A simplified life history was presented.

It should be noted that the Russians are fishing whiting. Domanevsky and Nozdrin 1963 have reported on general observations made on this species.

Whiting in the New York bight were investigated by Shaefer (1960). General growth analyses and food habit studies were reported.

Bibliography

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Form No. 2-127
6-60

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES   Contract No. 14-17-0007-175

V-4

This Contract, entered into this 4th day of October, 1963 by the United States of America, hereinafter called the Government, represented by the Contracting Officer executing this contract, and

Woods Hole Oceanographic Institution, Woods Hole, Massachusetts,

hereinafter called the Contractor, witnesseth that the parties hereto do agree as follows:

ARTICLE I. STATEMENT OF WORK. The Contractor shall furnish the necessary personnel, facilities, materials for performance of the following work.

The Contractor shall continue a program of investigation and observations (1) to detect changes in oceanic circulation (2) analysis of climatic and weather records to determine cause of such changes (3) investigation of circulatory system along North Atlantic coast to facilitate interpretation of observations, and (4) consultation and collaboration with U. S. Fish and Wildlife Service Laboratory, Woods Hole, Massachusetts, and as particularly set forth in the Contractor's proposal dated July 30, 1963, with the exception that on page 2 of the proposal, item 8, "Estimated costs: per year" this contract shall be limited to a total cost of $28,000.00. This adjustment is per a joint agreement between your Institution and Dr. H. W. Graham of this Bureau.

ARTICLE 2. COST. For performance of this contract the Government shall pay to the Contractor the sum of $28,000.00 payable as follows:

Quarterly on December 31, 1963, March 31, 1964, June 30, 1964, and September 30, 1963, in equal amounts of $7,000.00

33376

2-127
6-60

V.5

ARTICLE 3. PERIOD OF CONTRACT. Work shall be commenced October 1, 1963.
and shall be completed not later than September 30, 1964.

ARTICLE 4. GENERAL PROVISIONS. The attached "General Provisions", Form 2-127a, are incorporated herein and made a part of this contract.

ARTICLE 5. ALTERATIONS. The following changes were made in this contract before it was signed by the parties hereto:

Work performed beginning October 1, 1963, pursuant to informal instructions from Regional Director, Bureau of Commercial Fisheries, Gloucester, Massachusetts, is hereby confirmed and shall be deemed to have been performed under this contract.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

Woods Hole Oceanographic Institution	THE UNITED STATES OF AMERICA
(Contractor)	
By: Bostwick H. Ketchum	By:
Acting Director 11/4/63	Chief, Branch of Property Management
(Title)	(Title)

Department of the Interior
Fish and Wildlife Service

PROPOSED PROJECT UNDER SALTONSTALL-KENNEDY ACT
(P.L. 466, 83rd Congress, 2nd Session)

For consideration by the Industry Advisory Committee

1. Major field: Oceanography

2. Title of Project: Investigation of climatic and oceanographic factors influencing the environment of fish.

3. Proposed by: Woods Hole Oceanographic Institution
Paul M. Fye, Director

4. General description: The abundance and distribution of the great populations of fish change from time to time. The objective of this research proposal is to find out to what extent these changes are related to shifts in the ocean circulation, and what climatic influences may bring about such shifts. The fishing industry will benefit if it is known what factors other than fishing have influenced or are likely to influence the fisheries.

5. Method of procedure:

   1. Continuation of program of observations to detect changes in oceanic circulation.
   2. Analysis of climatic and weather records to determine cause of such changes.
   3. Investigation of circulatory system along North Atlantic coast to facilitate interpretation of observations. (Supported by other agencies).
   4. Consultation and collaboration with U. S. Fish and Wildlife Service Laboratory, Woods Hole, Massachusetts.

6. Work to be performed by: Woods Hole Oceanographic Institution.
Personnel available - Oceanographer with 26 years' experience, meteorologist with 20 years' experience.
Facilities - Oceangraphic equipment aboard 15 Lightships.

7. Estimated duration of the project: This contract is for 1 year.
Continuation to be anticipated since objectives are long range.

8. Estimated costs: per year

Salaries	$14,150
Indirect Costs (55% provisional)	7,782
Retirement (8 5/8% provisional)	1,220
Materials and Supplies	13,419
Travel (See Text)	2,000
Fee at 5%	1,929
	$40,500

Dean F. Bumpus

D. F. Bumpus, Principal Investigator

H. MacKillop

H. M. MacKillop, Comptroller

Bostwick H. Ketchum

Bostwick H. Ketchum, Associate Director

Amplification of Project for

<u>Investigation of oceanographic and climatic influences on the environment of fish</u>

Proposed by Woods Hole Oceanographic Institution

The Problem

One of the hazards of the fishing industry is the uncertainty in the numbers of fish to be found in any place at any time on any given fishing ground. Over longer periods the area frequented by a given species may contract or expand unaccountably.

The short-term fluctuations in the fisheries are known to result from "good" or "bad" success in each year's reproduction, but why large numbers of young fish survive in some years and not in others is not understood. Even more mysterious are the causes of the expansion of fish populations into new territory, or their disappearance from regions where they were formerly abundant.

Far too often the fishermen themselves are made a scapegoat, when it is charged that the changes are due to overfishing. Certainly this is not the cause of the good or bad years of reproduction, or of the cataclysmic destruction of whole populations, such as have occurred from time to time.

It is reasonable to believe that many of the fluctuations in the distribution of fish and in the success of their natural breeding arise from actual changes in the quality of their environment; to shifts in the temperature of the water, or its salinity, or in the currents which control the supply of food. This is the hypotheses on which the present proposal is based.

Along the Atlantic seaboard fishing is conducted chiefly within the limits of the continental shelf. In these waters the conditions influencing the environment of fish depend on three factors: (1) the general circulation of the Atlantic Ocean, and particularly the behavior of the Gulf Stream; (2) the discharge of rivers along the shore, which establishes and maintains the coastal circulation; and (3) the local climate which influences the temperature of the water.

A great quantity of information is being collected which bears on these influences. Oceanographers are now studying actively the oceanic circulation and have investigated from time to time various aspects of the coastal circulation. Systematic records of water temperatures are made at the tide stations maintained by the Geological Survey. Climatic data are now available in the records of the Weather Bureau. The flow of the coastal rivers are recorded by the Geological Survey. The fishery statistics supply an abundant record of the availability in time and place of the important fish populations.

The previous contract between this Institution and the U.S. Fish and Wildlife Service (Contract 14-19-008-2377, 14-17-008-62, 14-17-007-9 and 14-17-007-104) <u>commenced a sustained effort to relate the existing information to the behavior of</u>

fish.

and

systematic observations were made of the variability of the environment in the coastal waters where fish live, and of the variations in the circulation of that environment.

The Woods Hole Oceanographic Institution is qualified to secure and continue such observations and to correlate the information obtained, to the end that the relations of climate and oceanic circulation to the varying distribution and abundance of fish may be better understood.

Procedure

1. A program of observations will be maintained consisting of:

   a. The establishment, maintenance and servicing of systematic observations of temperature and salinity on twelve available lightships along the Atlantic coast. The object will be to secure data from as far seaward as possible.

2. A program of coordination of data will be maintained consisting of

   a. The collection and analysis of all available data from the tide stations, lightships, weather ships, and research vessels bearing on the actual state of coastal waters, and on the circulation of the adjacent deep ocean, including the Gulf Stream.

   b. The collection and analysis of all available meteorological and hydrological data bearing on the climate of the North Atlantic coast and on the flow of rivers into the sea.

   c. The analysis of the above information in relation to the accepted views of the coastal circulation, and the correlation of the findings with information obtained from fishery statistics.

3. An essential part of the proposal is that fundamental studies of the circulatory system of the continental coast be made as an aid in interpreting the fluctuations in the state of the coastal waters. The observations to be obtained will be of limited value if they cannot be interpreted in terms of well-recognized patterns of circulation. The character of the circulation in the Gulf of Maine and along the middle Atlantic coast has been studied by Bigelow and others but much more information is required, particularly in areas of acute interest to the fisheries. South of Cape Hatteras little was known of the coastal circulation until recently when Mr. Bumpus, who would serve as project leader under this proposal, undertook its study. Much valuable data on the hydrography of this area are available, to which attention should be given to perfect our knowledge of its waters. (This part of the project will be

supported in part by funds from other agencies.)

4. Personnel engaged in the program will be available to the Fish and Wildlife Service at all times for consultation on oceanographic and climatological problems. The Institution is located adjacent to the Woods Hole Laboratory of the Service and enjoys relations with the personnel of that laboratory which assure the cooperation and collaboration necessary for the success of the present proposal. Close relations have also been maintained with the Biological Laboratories at Boothbay Harbor, Maine; Sandy Hook, New Jersey and Beaufort, North Carolina.

Results:

The monitoring of the distribution of temperature and salinity at lightships along the Atlantic seaboard has resulted in a series of reports which describe the annual cycle of temperature and salinity and seek to explain the causes of changes which are observed.

Bumpus, D.F. 1957: Surface water temperatures along the Atlantic and Gulf Coasts of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 214, 153 pp.

Bumpus, D.F. 1957: Oceanographic observations, 1956, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 233, 132 pp.

Chase, J. 1959: Wind induced changes in the water column along the east coast of the United States. J. Geophys. Res. 64(8):1013-1022.

Day, C.G. 1959: Oceanographic observations, 1957, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 282, 123 pp.

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Day, C.G. 1960: Oceanographic observations, 1959, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 359, 114 pp.

Day, C.G. 1963: Oceanographic observations, 1960, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 406, 59 pp.

Chase, J.: Oceanographic observations, 1961, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries in ed.

The study of the circulation on the continental shelf has resulted in the following papers:

Bumpus, D.F., J. Chase, C.G. Day, D.H. Frantz, Jr., D.D. Ketchum and R.G.Walden 1957: A new technique for studying non-tidal drift with results of experiments off Gay Head, Mass., and in the Bay of Fundy. Jour. Fish. Res. Bd. Canada 14(6):931-944.

Bumpus, D.F. and C.G. Day, 1957: Drift bottle records for the Gulf of Maine and Georges Bank, 1931-1956. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 242, 61 pp.

Day, C.G., 1958: Surface circulation in the Gulf of Maine as deduced from drift bottles. Fishery Bull. 58(141):443-472.

Bumpus, D.F., 1960: Sources of water contributed to the Bay of Fundy by surface circulation. J. Fish. Res. Bd. Canada, 17(2):181-197.

Bumpus, D.F., 1961: Drift bottle records for the Gulf of Maine, Georges Bank and Bay of Fundy, 1956-58. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 378.

We intend, in the foreseeable future, to publish a folio on the surface circulation on the continental shelf, Cabot Straits to Florida, in the American Geographical Society's Serial Atlas of the Marine Environment.

Personnel and Facilities

The Woods Hole Oceanographic Institution is a non-profit corporation with over thirty years' experience in investigation of the western Atlantic Ocean. It operates five seagoing research vessels and employs a scientific staff of some sixty oceanographers, meteorologists, chemists, and biologists. It maintains simple technical services to support the scientific staff.

The proposed investigation will be placed under the leadership of Mr. Dean F. Bumpus, an oceanographer with twenty-six years' experience in the study of the hydrography and biology of coastal waters, assisted by Mr. Joseph Chase, a meteorologist with 20 years' experience, 13 of them directly associated with problems in physical oceanography.

Duration of Project

A continuation contract for one year is proposed. It is evident from the nature of the proposed work that its objectives are long range, and will have little value if not continued for a longer period.

The salary schedule provides for 20% of the principal investigator's salary, 50% of his associate's salary, full salary for two clerk-technicians and about 1000 hours of minimum wage service.

Indirect Costs are estimated to cover cost of occupany, maintenance, and administration. The actual rate is computed every six months based on actual costs as determined by Navy Auditors. All indirect costs are allocated between contracts with the government, with other contractors and the Institution's own work on the same basis.

The sum of $2000 budgeted for travel includes travel of the principal investigator to the ICNAF Environmental Symposium to be held in Rome in late January 1964, where he will be the convenor of one of the panels.

Signed Dean F. Bumpus

July 30, 1963

D. F. Bumpus, Prin. Investig.

Investigations of Climate and Oceanographic Factors Influencing the Environment of Fish.

Accomplishments to date are these:

1. Continuing series of temperature and salinity measurements at a dozen or more lightship and other locations from Maine to Florida since the end of 1955. These measurements have revealed the effect of drought and subsequent high precipitation on the hydrography of the Gulf of Maine, the annual mid-summer intrusion of cold saline water along the bottom toward the coast off New Jersey, Delaware and Virginia, and are beginning to be useful in examining the effect of climatic trends.

2. Never before have so many drift bottles been released and recovered as there has in the joint U. S. and Canadian surface circulation study. During the 11 year period ending in 1962, 160,423 drift bottles were released; over 10.1% were recovered. This data is being used to prepare a series of surface circulation charts to be published in the American Geographical Society's Folio Atlas series.

3. A simple device, for use in much the same manner as the drift bottle, has been developed for gaining information on the non-tidal drift along the bottom. Our understanding of this circulation is beginning.

4. A telemetering or transponding drift buoy system has been devised for observing non-tidal currents at mid-depths. Experiments have been conducted south of New England, in the Bay of Fundy, on Georges Bank, and between Cape Cod and Cape Hatteras.

5. Through contracts with AEC, experiments employing Richardson Current Meters have been conducted south of New England. Some experiments off Cape Canaveral have been highly successful. If we can maintain our patience during this trying developmental period, we shall have a real break-through. The need for direct current measurements has been obvious for many years. Its achievement is in sight!

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John B. Colton, Jr.

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Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
431 Coastal and Offshore Research	Plankton	431.36

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		17,071	17,071 100
21. Travel and Transportation of Persons		200	200
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		400	400
31. Equipment		400	400
Other			
Sub Total Program Direct Cost 1/		18,071	18,071 18,100.
Program Indirect Cost		14,700	14,700
TOTAL OPERATING PROGRAM		32,771	32,771 32,800.

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Analysis of previous cruise data		9,035.50	9,035.50 9050
B	Zooplankton Com. Studies		9,035.50	9,035.50 9050.
	Sub Total Program Direct Cost 1/		18,071	18,071 18,100.
	Program Indirect Cost		14,700	14,700
	TOTAL OPERATING PROGRAM		32,771	32,771 32,800.

NOTED BY REGIONAL OFFICE

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Title Date

Approved By: Herbert W. Graham Name Laboratory Director Title 7/29/63 Date

Personnel (name)	Grade	Cost
Colton	GS 12	10,966
Stoddard	6	6,105
Total personal services		17,071

Region #3

Briefing Statement
(In thousands of dollars)

Program Without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	33.5	33.5	31.2	31.2
431	Plankton	PP	2	2	2	2

Program:

Work plan: Sampling with plankton collectors in area between New York and Nova Scotia. Identification of zooplankton.

Objective: To describe the quantity and components of the plankton, and to relate these to the occurrence and abundance of groundfish.

Accomplishments FY 1963: Species composition and abundance of zooplankton determined for collections made in 1940 and 1960 in the Gulf of Maine and Georges Bank area.

Base of operations: Woods Hole, Massachusetts.

Briefing Statement
(In thousands of dollars)

Program with Increase

Region #3

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	65.0	65.0	--	--	--
131	Plankton	PP	--	--	--	--	--

Increase:

Need: Plankton comprises the basic forage organisms for all marine fish. A knowledge of the plankton in the area is essential to an understanding of the relation of abundance and distribution of groundfish to their basic food source. This program has been supported on a small scale by S-K funds, but effort was devoted to analysing samples on hand.

Work plan: Extensive sampling stratified by depth and time conducted by the research vessel ALBATROSS IV.

Objective: To describe the quantity and components of the plankton, and to relate these to the occurrence and abundance of groundfish.

Additional positions: None.

Program:

Objective: To determine the productivity of zooplankton in the area.

Accomplishments FY 1963: Species compositions and abundance of zooplankton determined for collections made in 1940 and 1960.

Base of operations: Woods Hole, Massachusetts

Form 2-102 (Rev. July 1963) X-1

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
431 Coastal and Offshore Research	Population Dynamics	431.20

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		41,084	41,084 — 41,100.
21. Travel and Transportation of Persons		200	200
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		600	600
31. Equipment		200	200
Other — Computer		5,000	5,000
Sub Total Program Direct Cost		47,084	47,084 — 47,100.
Program Indirect Cost — 3/A		28,900	28,900
TOTAL OPERATING PROGRAM		75,984	75,984 — 76,000.

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Est. Effects of Fishing		28,250.40	28,250.40 — 28,25[illegible]
B	Theoretical Studies		9,416.80	9,416.80 — 9,42[illegible]
C	Tagging		9,416.80	9,416.80 — 9,42[illegible]
	Sub Total Program Direct Cost		47,084.00	47,084.00 — 47,10[illegible]
	Program Indirect Cost — 3/A		28,900.00	28,900.00
	TOTAL OPERATING PROGRAM		75,984.00	75,984.00 — 76,0[illegible]

NOTED BY REGIONAL OFFICE

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name / Title / Date

Approved By: Herbert W. Graham — Laboratory Director — 7/19/63

30579

Personnel (name)	Grade	Cost
Hennemuth	GS 13	12,353
Brown	9	7,386
Callahan	6	6,665
Dryer	7	7,167
Cogswell	7	7,353
Total personal services		41,684

Briefing Statement
(In thousands of dollars)

Region #3

Coastal and Offshore Research

Program Without Increase

(Subactivity)

No.	Title		1965	1964	1963	1962
		$	78.0	73.0	72.0	76.0
431	Population Dynamics	PP	5	5	5	5

Program:

Work plan: Biological data on landings in all New England fishing ports are transmitted to Woods Hole Laboratory for analysis. These data along with information collected by research vessel ALBATROSS IV are used in measuring the changing abundance of cod, haddock, redfish, silver hake, flounders, and sea scallops.

Objective: To determine the effect of fishing on the stocks of the above species; to assess the possible effects of regulation of the fisheries; and to make recommendations for management of these fisheries.

Accomplishments FY 1963: Processing of data from the ports has been kept current. Annual biostatistical reports have been submitted to ICNAF. Assessment of effects of different mesh sizes on the stocks of groundfish in the area has been made.

Base of operations: Woods Hole, Massachusetts.

POPULATION DYNAMICS PROGRAM--REVIEW OF PAST WORK

Georges Bank Haddock

Herrington (1948) attempted to define the relationship between adult biomass, food, and recruitment. His study indicated that maximum recruitment resulted from medium stock biomass and that food was a limiting factor at high densities. The analysis showever, was not wholly convincing.

Schuck (1949) demonstrated that there was a significant relationship between removals by the fishery and decrease in population size on an annual basis. Thus, the annual catches of 75 million pounds or more were affecting the stock significantly.

Graham (1952) presented estimates of growth rate, mortality rate, average age of entry into the catch, and the yield-per-recruit as a function thereof. These studies indicated a substantial increase in yield per recruit could be obtained by delaying the age of first capture from 1 1/2 to 3 years of age. The magnitude of natural and fishing mortality rates were, however, only considered opinions, hence the actual expected yields were somewhat uncertain. This study formed the biological basis of the present mesh regulation, begun in 1953.

Subsequent studies to determine the effects of the mesh regulation (Graham, 1958; Graham and Premetz, 1955; and other processed reports) established the effective release of small fish, and somewhat increased catches of larger sized fish. The expected increase in yield-per-recruit could not be discerned from the available data. Taylor (1958) attempted to estimate natural and fishing mortality components, but was not successful.

Other fisheries

Royce, Buller, and Premetz (1959) attempted to determine if the changes in yellowtail flounder population were related to fishing pressure. The study disclosed apparent fishery-independent variations in stock magnitude which could not be explained. Gulland (1961) reviewed some aspects of estimating the effects of fishing on redfish. His analysis of abundance and effort for redfish in the Gulf of Maine indicated that the maximum average annual effort thus far imposed had not reached the level corresponding to maximum sustained yields.

The report of working groups of scientists on fishery assessment in relation to regulation problems (Beverton and Hodder, 1961) attempted to evaluate effects of mesh regulation and fishing on the yields of major species in the ICNAF area. The report concluded:

1) Mesh size for the various species in various areas could not be uniformly regulated to produce maximum yields-per-recruit. For cod mesh size up to 5 or 6 inches would be most beneficial. For haddock a mesh size of 4 1/2 appeared optimal. The estimated gains in yield were, on the whole, small. Long term assessments for redfish were not possible.

2) The fishery had, in many cases, significantly reduced the abundance, but in no instance was it possible to relate accurately the maximum sustainable yield point to a given fishery intensity.

3) For almost all stocks, the information required for adequate assessment of effects of fishery was lacking.

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REGIONAL ADP UNIT

The automatic data processing unit became operational in November, 1962. The unit is designed to handle (1) the basic compilations of fishery statistics for the Regional activities, ICNAF and Woods Hole Laboratory, and (2) data reduction for research projects within the Region's laboratories.

The unit is equipped with the following machines: an Alpha printing punch located in Gloucester, and the following at Woods Hole:

1) Alpha printing punch
2) 1000 card per minute Alpha Sorter
3) 100/150 card per minute Alpha Accounting Machine
4) 150 card per minute Reproducing Punch
5) 150 card per minute Collator

The unit is currently handling on a routine basis the following jobs:

A. Commercial Fishery Statistics.

1. Dealer Weighout Schedules. Provides total landings and effort of New England fleet, 150,000 cards-per-year. Reports prepared for the Washington, the Office of Statistical Services, Gloucester (OSS), for ICNAF and for the Woods Hole Laboratory.

2. Vessel Interviews. Provides details of each trip interviewed, 75,000 cards-per-year. Mostly for Woods Hole Laboratory use.

3. Length and age composition of landings, 30,000 cards-per-year. Reports prepared for ICNAF Sampling Yearbook, and Laboratory use.

B. Research Vessel Surveys.

1. Groundfish species records and hydrography.

2. Benthos species records and environmental factors.

In addition, many special sets of data are processed for research projects; e.g., Mid-Atlantic temperatures, length-weight analyses for groundfish, industrial fishery study. A tremendous backlog of important historical data on the New England fisheries exists which we are slowly punching and processing in order to provide rapid retrieval and analysis of the data.

Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES.

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
431 Coastal and Offshore Research	Redfish	431.02

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		24,804	~~24,804~~ 24,850.
21. Travel and Transportation of Persons		400	400
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		1,000	1,000
31. Equipment		600	600
Other			
Sub Total Program Direct Cost		26,804	~~26,804~~ 26,850.
Program Indirect Cost 7/A		12,100	12,100
TOTAL OPERATING PROGRAM		38,904	~~38,904~~ 38,950.

BREAKDOWN BY PROGRAM FEATURE

NOTED BY REGIONAL OFFICE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Racial and Distribution Studies		8,935	~~8,935~~ 8,950.
B	Growth Studies		8,935	~~8,935~~ 8,950.
C	Migration Studies		8,934	~~8,934~~ 8,950.
	Sub Total Program Direct Cost		26,804	~~26,804~~ 26,850.
	Program Indirect Cost 7/A		12,100	12,100
	TOTAL OPERATING PROGRAM		38,904	~~38,904~~ 38,950.

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Herbert W. Graham Title Date

Approved By: Herbert W. Graham Title Laboratory Director Date 7/19/63

30579

Personnel (name)	Grade	Cost
Kelly	GS 12	11,361
Barker	7	7,353
Chase	6	6,180
Total personal services		24,894

Briefing Statement
(In thousands of dollars)

Region #3

Program Without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	40.0	40.0	38.1	38.0
431	Redfish	PP	3	3	3	3

Program:

Work plan: Sample commercial catch; sample the actual populations; determine growth and mortality rates and division of stocks.

Objectives: To obtain the biological information required to understand the causes of fluctuations in availability and abundance (see 2nd sheet) of redfish in the Northwest Atlantic.

Accomplishments FY 1963: Effect of tagging on growth rate on a shallow water population was determined. Fluctuations of a number of populations in the Gulf of Maine were related to the fishing pressure.

Base of operations: Woods Hole, Massachusetts.

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	30.0	30.0	- -	- -	- -
131	Redfish	PP	- -	- -	- -	- -	- -

Increase:

Need: Redfish is one of the most important groundfish in the Northwest Atlantic being one of the four species singled out for intensive study by the International Commission for the Northwest Atlantic Fisheries. The program has been supported by S-K funds but increases are needed to intensify the attack on this deepwater fish which is difficult to study.

Work plan: Extensive sampling of adult, juvenile, and larval stages throughout a wide area by means of bottom trawls, midwater trawls, and plankton collectors using the ALBATROSS IV as the principal floating equipment.

Objective: To attack the vexing problem of the relationship of the many stocks of redfish in the Northwest Atlantic.

Additional positions: None

Program:

Objective: To obtain the biological information required to understand the causes of fluctuations in abundance or availability of redfish.

Accomplishments FY 1963: Effects of tagging on growth rate on a shallow water population was determined. Fluctuations of a number of populations in the Gulf of Maine were related to the fishing pressure.

Base of operations: Woods Hole, Massachusetts.

Review of Knowledge of Redfish (Sebastes) in the Northwest Atlantic

Introduction

A large international fishery for redfish (Sebastes) developed in the North Atlantic about 1930, increased to a peak of 1.4 billion pounds landed in 1959, and has begun to decline. Prior to the start of the commercial fishery, knowledge of Sebastes was limited to fragmentary observations of specimens taken during deep water explorations in various parts of the North Atlantic. Landings statistics from the commercial fishery have provided much of our distributional information for remote areas of the redfish range. As the fishery expanded, new forms of redfish were found which led to new interpretations of the systematics of the genus. As a result, redfish research has had difficulty in keeping pace with the expansion of the fishery, and most of the problems encountered in redfish studies are related closely to difficulties in defining species, races, and stocks of Sebastes across the whole North Atlantic Ocean.

Distribution

North Atlantic Sebastes stocks are distributed on the deep water fishing banks from the southern slope of Georges Bank, off southern New England, northeastward to the northern coast of Norway. Redfish are found generally in depths between 50 and 300 fathoms, and are confined to the temperature zone between 35° and 52° F. The Sebastes range is bounded approximately by the Gulf Stream on the south and Arctic waters on the north.

It has been very difficult to study the biology of redfish because of its deep-water distribution. Significant contributions to knowledge of mid-water distribution of Sebastes in the eastern North Atlantic were made by Nansen (1886), Hjort (1901), Jensen (1922), and Taning (1949). In the western Atlantic, Bigelow and Welsh (1925) and Bigelow and Schroeder (1953) summarized the general distribution of redfish in their excellent review of redfish general biology. Schroeder (1955) investigated the maximum depth distribution of redfish along the Nova Scotia shelf. Kelly and Barker (1961) obtained information on the minimum depth requirements of redfish with the rediscovery of a shallow water redfish population at Eastport, Maine, first recorded by Verrill (1871). Templeman (1959) published a comprehensive review of Sebastes distribution in the whole North Atlantic. He cites many of the problems encountered in larval distribution and systematics studies.

Systematics

Three closely allied species of the genus Sebastes have been described from the eastern North Atlantic; S. marinus (Linnaeus), 1758, S. viviparus (Kroyer), 1844-45, and S. mentella (Travin), 1951. S. marinus is the type species for the genus in the family Scorpaenidae. Recent fishing has disclosed many redfish intermediate in form between marinus and mentella, and the validity of S. mentella as a species has been questioned (Andriiashev, 1954). The commercial fishery has exploited only the marinus and mentella types of redfish to the present time. S. viviparus is a smaller species that is probably not sufficiently numerous to be fished commercially.

In the western North Atlantic, the name *Sebastes marinus* was used for redfish by early authors such as Storer (1839 and 1846), Jordan and Gilbert (1882), Goode and Bean (1895) and Jordan and Evermann (1898), implying that a single species existed across the whole North Atlantic. In 1854, Storer described a new redfish species, *S. fasciatus*, from a single small specimen taken near Provincetown, Mass. This specimen was lost in a fire many years ago and its true taxonomy will never be known. However, with our present knowledge of young redfish pigmentation, it is apparent that Storer's description of *fasciatus* could apply equally well to many young specimens of the common New England redfish.

Ginsburg (1953) and Bigelow and Schroeder (1953) both continue to class redfish of the Gulf of Maine region as *Sebastes marinus*.

A cooperative program was organized by ICNAF in 1957 to obtain specimens from all major North Atlantic redfish populations for meristic and morphometric examination by U.S. investigators at Woods Hole. The results were reported at the Redfish Symposium in 1959 (Kelly, Barker and Clarke, 1961) indicating that objective measurements of a large number of characteristics did not separate *marinus*-type and *mentella*-type redfish into identifiable groups, even in areas where both were said to occur. Fish from eastern and western Atlantic were not taxonomically separable despite considerable differences in size composition and growth rate.

At the Redfish Symposium, several promising studies were reported employing biochemical or chromatographic techniques for separating *Sebastes* groups according to differences in sera, mucus or blood type (O'Rourke, 1961, Schaefer, 1961, Sindermann, 1961). The results of these new techniques were sufficiently encouraging to suggest that work of this nature be given greater emphasis. Some other studies reported at the same meetings employed differences in vertebral numbers and variations in otolith shape and size as possible specific characteristics. None of these studies showed adequate differences for species separation. Since that time no additional studies have been reported which have helped to clarify the confused *Sebastes* taxonomy.

Larval distribution

The distribution of redfish larvae has been investigated in many parts of the *Sebastes* range. In his studies of the plankton and hydrography of the Gulf of Maine, Bigelow (1914) obtained much information on horizontal distribution of redfish larvae. Dannevig (1919) and Jensen (1922) studied the drift of redfish larvae in the Gulf of St. Lawrence and coast of Greenland respectively. Taning (1949) continued study of the oceanic distribution and drift of redfish larvae in the Iceland-Greenland area with special reference to the existence of a large, bathypelagic population of breeding adults.

High-speed samplers have been employed recently by several investigators to study vertical distribution of larvae. Einarsson (1960) used the Gulf III around Iceland, Kelly and Barker (1961) sampled the Gulf of Maine with the Isaacs-Kidd mid-water trawl, and Henderson (1961 and 1962) reported the routine use of the Hardy Continuous Plankton Recorder on the shipping lanes between the United Kingdon, Iceland, Greenland and North America.

Problems in the identification of pelagic Sebastes larvae have arisen. Taning (1961) contains the posthumous publication of descriptions and drawings of S. marinus and S. viviparus larvae and post-larvae based on work done many years earlier. Templeman and Sandeman (1959) reported the caudal pigmentation of preextrusion Sebastes larvae in the Newfoundland area showing mentella larvae to bear caudal pigment. No larvae from the type locality of mentella (Barents Sea) were found to have caudal pigment.

Age and growth

Redfish age and growth studies have occupied much of the time of investigators in the past. The earliest studies by Smaragdova (1936), Veshchezerov (1944) and Perlmutter and Clarke (1949) in different parts of the range all indicated Sebastes to be slow-growing, long-lived fish. Kotthaus (1952) suggested that previous studies had interpreted age incorrectly and redfish were in reality quite fast-growing, and a controversy developed. Validation of the ageing technique on young of the year redfish was undertaken in the Gulf of Maine and on the Norwegian coast. Papers by Bratberg (1956) and Kelly and Wolf (1959) showed the growth of young redfish to be very slow, and nearly the same, on both sides of the Atlantic. The extensive collections of young of the year in the plankton, at mid-depth and on the bottom in the Gulf of Maine was a major factor in resolving this dispute.

The first successful tagging and recapture of redfish at Eastport, Maine, (Kelly and Barker, 1961) offered the final proof to non-believers that redfish could actually grow as slowly as growth studies had indicated. Subsequent tagging studies (Kelly and Barker, 1963) showed that growth rate could be critically altered by the use of certain tag types. Repeated recapture of the same tagged fish showed that individuals whose growth had been totally arrested for several years could resume near normal growth with the removal of the old tag and replacement with a different type.

Parasite infestation

Little study has been given to the general infestation of parasites in and on redfish, but a considerable bulk of data has been accumulated about Sphyrion lumpi, a copepod ectoparasite that is very abundant and costly to the fisherman in the areas where it occurs. Wilson (1919) established the new copepod family and classified the parasite properly. With the start of the redfish fishery in the Gulf of Maine, Herrington, Bearse and Firth (1940) reported on the life-history and occurrence of Sphyrion in the Gulf of Maine, and on the incidence of the parasite's remains in redfish fillets. Sindermann (1961) lists this species as a possible tag for marking redfish populations. Templeman and Squires (1960) reported on the incidence of the parasite in the western Atlantic, primarily around Labrador and Newfoundland. Kelly and Barker (Ms.) have newly completed a summary of the detailed incidence of Sphyrion in the Gulf of Maine to be presented at the ICES/ICNAF/FAO Environmental Symposium to be held at Rome, Italy late in January, 1964.

Gear selectivity

Gear selectivity has been comparatively small attention with respect to redfish trawling. Small mesh nets have been favored by the fishermen to minimize the amount of "meshing" of small redfish below the size preferred by the fishery. Clark (1957) reported the results of mesh experiments done in the Gulf of Maine. Increasing mesh size increased the size of redfish retained, and also increased the quantity of commercial sized redfish that were entangled in the meshes of the net.

Population dynamics

The first redfish population dynamics study was done by Davis and Taylor (1957) using Gulf of Maine growth rate and landings statistics from the U. S. fishery. This rather elementary study suggested a low natural mortality rate for Gulf of Maine redfish. An assessment committee appointed by ICNAF reported on the theoretical, probable effects of increasing mesh size on the redfish fishery in each statistical subarea of the ICNAF area (Beverton, 1961). The effect of increasing mesh size from about 2 3/4" to 4 1/2" would be substantial immediate losses of redfish landings in all subareas, and only small long-term gains in a few areas with long-term losses in most areas. No further studies along these lines have been undertaken.

When a recommendation was made that 4 1/2" mesh be used for all species in the ICNAF subareas north of the Grand Banks, there was no evidence that it would benefit the redfish fishery, but it was approved on the grounds that the regulation would do no harm to the redfish stocks.

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Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
1.31 Coastal and Offshore Research	Sea Scallops	1.31.83

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		26,315	~~26,315~~ 26,350.
21. Travel and Transportation of Persons		200	200
22. Transportation of Things		5,200	5,200
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		1,600	1,600
31. Equipment		1,200	1,200
Other			
Sub Total Program Direct Cost		34,515	~~34,515~~ 34,550.
Program Indirect Cost 1/A Alb IV		38,400	38,400
		9,000	9,000
TOTAL OPERATING PROGRAM		81,915	~~81,915~~ 81,950.

BREAKDOWN BY PROGRAM FEATURE

NOTED BY REGIONAL OFFICE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Biological and Ecological Studies		17,257.50	17,275. ~~17,257.50~~
B	Management		17,257.50	17,275. ~~17,257.50~~
	Sub Total Program Direct Cost		34,515.00	34,550. ~~34,515.00~~
	Program Indirect Cost 1/A Alb IV		38,400.00	38,400.00
			9,000.00	9,000.00
	TOTAL OPERATING PROGRAM		81,915.00	~~81,915.00~~ 81,950.

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name Herbert W. Graham Title Date

Approved By: Name Herbert W. Graham Laboratory Director 7/19/63 Date

30579

Personnel (name)	Grade	Cost
Posgay	GS 13	13,370
Haynes	9	7,[illegible]
Jensen, H.	5	5,[illegible]
Total personnel services		26,[illegible]

Equipment List

Experimental Scallop Dredge	1,000

Briefing Statement
(In thousands of dollars)

Region #3

Program without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	84.0	84.0	82.0	80.0
431	Sea Scallop	PP	4	4	4	4

Program:

Work plan: Sample the commercial catch and survey the beds with research vessel ALBATROSS IV.

Objective: Determine the effect of fishing on the stocks; make recommendations for management; study natural fluctuations in abundance and make predictions.

Accomplishments FY 1963: Analysis of port sampling is current. It has been determined that the age at which this shellfish is taken should be delayed one year.

Base of operations: Woods Hole, Massachusetts

REVIEW OF SEA SCALLOP PROGRAM

This program began in December 1954. At that time, there was very little in the literature on which to build. Hugh M. Smith (1891) had published a narrative account of the sea scallop fishery along the Maine Coast. Gilman A. Drew (1906a and 1906b) had sketched in some of its habits, morphology, and physiology. Lloyd M. Dickie (1951) gave an account of the fishery around Prince Edward Island and (Dickie, 1955) in the Bay of Fundy. J. A. Posgay (1953) had described spawning and growth in Cape Cod Bay.

There was almost nothing known about the Georges Bank stocks. William F. Royce had begun collecting landings statistics in 1943 at New Bedford, Mass., and these had been published by Premetz and Snow (1953). These historical data have since proved to be extremely useful in our understanding of this fishery.

In 1955 we began to collect length frequency samples at New Bedford in addition to the information on pounds landed, days fished, and area of capture. Although we had only a rough estimate of the growth rate, it was immediately obvious that the fishery was largely dependent on the newly recruited year class. A recording measuring board was devised (Posgay, 1958a) to speed the collection of length frequency data. Some attempts were made at direct measurement of abundance by underwater photography.

In 1956 and 1957 we improved our estimate of the growth rate using the Petersen method, started what became an extensive tagging program, began to estimate mortality rates, and made our first ventures into population dynamics calculations. The results of our investigations to date were reported orally to Panel 5, ICNAF, in June 1957. Papers were published on the vessels and gear used in the fishery (Posgay 1957a) and the range of the sea scallop (Posgay 1957b).

In 1958 Arthur Merrill succeeded in developing objective criteria for identifying annual rings on the shells of sea scallops from Georges Bank. His methods were validated (Merrill et al ms) by comparing his derived growth rates with those derived from the growth of tagged and recaptured animals. The manuscript describing these methods is currently under revision. A paper (Posgay, 1958b) was presented at the Annual Meeting of the International Commission for the Northwest Atlantic Fisheries giving a history of the fishery, a description of the gear, the results of our gear selection work, estimates of growth and mortality rates, and the results of inserting these rates in the Beverton and Holt population model. The basic conclusion of this paper was that changes in the level of fishing pressure would not affect the yield of a year class much, but that postponing the age of first capture would increase the yield. A paper on underwater photography (Posgay 1958c) and another documenting the spawning time (Posgay and Norman, 1958) were published.

In 1959 Arthur Merrill discovered over 10,000 sea scallops less than 10 mm. in size among the fouling organisms on a navigation buoy. These sizes are rare in collections made on the bottom. This enabled him to work out the changes in shell morphology during the larval and postlarval stages (Merrill 1961) and demonstrated that the larvae were planktonic. Using the new shell reading technique, growth rates were calculated for all major fishing grounds. A study was begun of the scallop grounds in the vicinity of Hudson Canyon. A device to measure the distance traveled while dredging was developed. This makes our collections quantitative. Posgay (1959a) gave a paper on underwater photography at the International Oceanographic Congress. The report to ICNAF (Posgay, 1959b) summarized the previous year's research and concluded that all evidence pointed to increased yield if the age of first capture were postponed. The Commissioners proposed that sea scallops be brought under the terms of the Convention; this later was done.

In 1960, a survey was made to learn something of the distribution of sea scallops along the Middle Atlantic Coast (Merrill, 1960). An extremely abundance year class had been recruited to the Georges Bank fishery during 1959. In certain areas, where earlier year classes were scarce or absent it was possible to study the effect of the fishery on the stocks very closely. Research vessel from one such ground samples showed a total mortality rate of 85 percent during the first year after recruitment. About 8 percent of this was due to natural mortality, the rest to fishing. The report to ICNAF (Posgay, 1960) discussed this and concluded that the 9.3 million pounds supplied by this year class from the Southeast Part ground would have been 12.3 million if recruitment had been postponed one year, and 14.3 if postponed two years for the same amount of effort. The growth rate of this, the most densely aggregated year class that we had ever observed, was somewhat higher than the average we had previously calculated for the same area.

In 1961, Posgay (1961a) presented a paper at the ICNAF Tagging Symposium which analyzed the return of about 2,800 tagged shells out of some 13,000 released. They were used to calculate growth rates, validate the shell reading method of ageing, deduce the season of ring formation, and document the lack of movement. In 2-1/2 years at large, 80 percent of the recoveries were reported within 2 miles of the place of release. The report to ICNAF (Posgay 1961b) discussed abundance, mortality rates, growth rates, and predicted yield. As before, it was concluded that rather large changes in fishing pressure would not affect yield very much and that postponement of age at first capture would increase yield. Posgay (1961c) sent a paper on the design of Albatross IV to FAO Research Vessel Forum.

Some tank experiments were conducted in 1962 to learn if our tags inhibited movement. The tagged animals moved about in the same manner as the untagged. We also learned that noise, pressure waves, in the water stimulated scallops to swim and that they are positively phototactic. An analysis of 18 years landings from Georges Bank showed that these relatively restricted areas supplied most of the catch. By restricting our sampling area, we are able to make more efficient use of ship time. Our abundance index showed a 30 percent decline from 1961. Comparing quantitative samples collected in 1962 with those collected in 1961 showed a total mortality rate (Z) of 9.75. All gear selection data collected by the United States and Canada was analyzed. It showed that simple increasing the size of ring used in the dredge would not result in a satisfactory savings gear. The report to ICNAF (Posgay 1962) predicted an 18 percent increase in the yield of a year class if age of first capture were postponed one year, and a 29 percent increase if it were postponed two years. A paper by Bourne (1962) reported on our inability to predict the precise quantitative effect of using larger rings in the dredges on the size composition of the catch.

In 1963, an analysis of all age composition samples gave a total mortality estimate of 0.73. The abundance index for Georges Bank was down 40 percent compared to 1962. All the growth rate samples, a total of 7,600 shells collected from 16 areas between 36 degrees and 51 degrees North Latitude, were placed on punched cards and run through an IBM 7090 computer. Posgay (MS 1963) started a paper on the growth rate of the sea scallop throughout its range. Manuscripts on the natural mortality rate (Merrill and Posgay, MS 1963) and variations in the length-weight ration (Haynes MS 1963) were submitted for publication.

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------ 1958a. A Recording Measuring Board. Progressive Fish Culturist, Vol 20, No. 3

------ 1958b. Maximum Yield in the Sea Scallop Fishery, Document No. 28, Annual Meeting ICNAF.

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------ 1959b. United States Sea Scallop Research in Sub-area 5 During 1958. Document No. 10, Annual Meeting ICNAF

------ 1960. United States Sea Scallop Research During 1959 in Sub-area 5Z Document No. 30, Annual Meeting ICNAF

------ 1961a. (in press) Tagging as a technique in population studies of the sea scallop. Proceedings of the North Atlantic Fish Marking Symposium, ICNAF

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------ 1961c. The design of a fishery-oceanographic research vessel for the North Atlantic. Proceedings of the Tokyo Research Vessel Forum, F. A. O.

------ 1962 Maximum yield per recruit of sea scallops. Document No. 73, Annual Meeting, ICNAF

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New England Industrial Trawl Fishery

The industrial trawl fishery in the broad sense began in New England during the late 40's. That part of the fishery that contributed so heavily to New England landings during the last decade existed primarily because of the sizeable demand for protein animal food supplements. For a time, 1954-1959, landings averaged over one hundred million pounds a year. This fishery declined rapidly coincident with the development of the Peruvian anchovy fishery and the local decrease in abundance of menhaden. Another segment of the industrial fishery, that for pet and mink food, has continued to develop at a slow but steady pace, landing at present about 25 million pounds a year.

The animal food protein supplement industry used all species caught and landed. The fishery depended largely upon the red hake, an abundant and otherwise unutilized species. The silver hake contributed significantly to the catch from Gulf of Maine grounds making up about 25 percent of the total catch by weight, and less than 15 percent from southern New England areas, while the red hake made up about 50 percent and 70 percent of the total catch respectively. The remainder of the catch included a variety of species, most of which had little or no commercial value.

The fishery has been described in the following short papers:

Edwards, R. L. and F. E. Lux, 1958.
New England's Industrial Fishery. CFR, Vol. 20, No. 5.

Edwards, R. L., 1958.
Gloucester's Trawl Fishery for Industrial Fish. CFR, Vol. 20, No. 8.

The species composition of the catches has been reported in the following Special Scientific Reports:

Edwards, R. L., 1958.
Species composition of industrial trawl landings in New England, 1957. SSR 266.

Edwards, R. L. and L. Lawday, 1960.
Species composition of industrial trawl landings in New England, 1958. SSR 346.

At the present time the industrial fishery shows signs of increasing activity. Mink food landings, the catch is sorted to remove everything but red and silver hake, average around 25 million pounds a year. Quaker Oats has set up a pet food plant in New Bedford with the capability of handling about 1 million pounds a week. In the summer of 1963, approximately 71 million pounds of unsorted trawl species were landed for reduction at Amagansett, Long Island.

GLOUCESTER'S TRAWL FISHERY FOR INDUSTRIAL FISH

By Robert L. Edwards*

DISCUSSION AND SUMMARY

The Gloucester trawl industrial fishery is based primarily on a whiting economy, in contrast to that of southern New England which is based on a flounder economy. Red hake are the principal species landed for reduction at Gloucester, with whiting ranking second in quantity. On southern New England grounds, skates make up a considerable portion of the trawl industrial landings, but in the Gulf of Maine, several species, depending on area and season, take third place. These include the angler, eelpout, and alewife. Only very small quantities of food fish are landed in the industrial catch at New Bedford and Pt. Judith from southern grounds while consistent small percentages of haddock, dab, and white hake show up in Gulf of Maine landings.

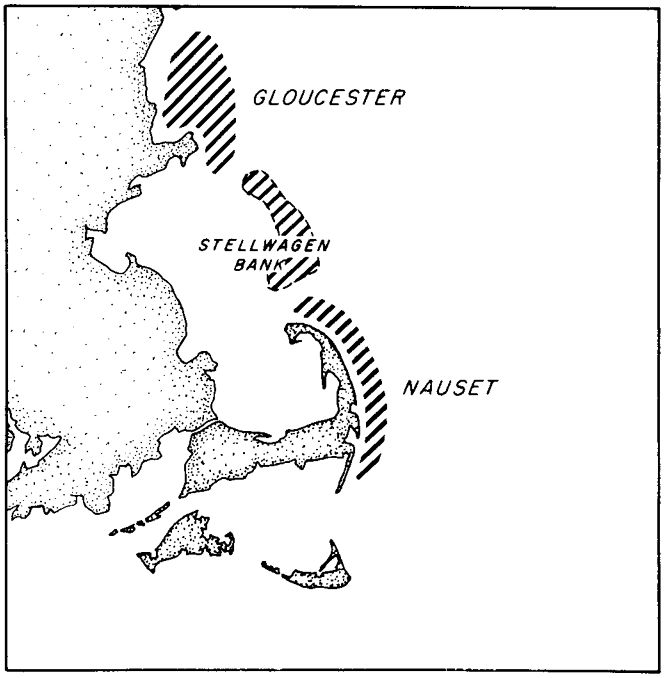

Fig. 1 - The three principal areas fished by Gloucester trawl fleet fishing for industrial fish.

The term "industrial fish" as used here refers to those species commonly taken by trawlers and referred to as "trash fish." They are taken along with desired food species and sold separately for reduction to fishery byproducts or meal plants.

Menhaden are industrial fish in the strict sense of the word, but they are the object of a highly specialized purse-seine fishery and they are not covered in this article. Because of their high oil content, reduction plants prefer menhaden since they yield both meal and oil. Industrial trawl fish are useful only as a source of meal because they contain only very small amounts of oil.

Table 1 - Gloucester Trawl Industrial Fish and Menhaden Landings by Month, 1955 to 1957

Months	1957		1956		1955	
	Trawl Fish	Menhaden	Trawl Fish	Menhaden	Trawl Fish	Menhaden
	. . . .	. . . . .	(1,000 Lbs.)	. . . . .	. . . . .	. . . . .
January	127		100		421	
February	65		24		344	
March	25		54		66	
April	8		100		272	
May	1,762		735		2,110	
June	3,330	1,513	1,775	8,384	609	5,558
July	4,540	13,300	1,100	36,236	254	20,577
August	6,117	3,577	2,175	17,832	2,925	21,371
September	7,454	2,311	3,348	3,957	1,399	12,672
October	7,362		2,009		2,519	1,102
November	5,500		2,400		2,022	
December	1,351		2,163		1,290	
Totals	37,641	20,701	15,983	66,409	14,224	61,280

The trawl fishery for industrial fish started in Gloucester as elsewhere in New England in 1949. The Gloucester landings of this fishery have not been very consistent or large, although in recent years a slow but steady increase has occurred. As a result of the very poor landings of menhaden in 1957, the Gloucester landings of trawl industrial fish more than doubled, amounting to over 37 million pounds (see table 1). During this same year, over 42 million pounds were landed at New Bedford and almost 100 million pounds landed at Pt. Judith.

*Fishery Research Biologist, North Atlantic Fishery Investigations, Division of Biological Research, U. S. Bureau of Commercial Fisheries, Woods Hole, Mass.

The Gulf of Maine and southern New England trawl industrial fisheries differ in their emphasis on food species. In general, the southern New England fishery is based on a flounder economy, directing its effort toward the capture of yellowtail flounder, fluke, and blackback flounder, in addition to red hake and other "trash" species. The Gloucester whiting-industrial fishery is primarily for whiting with secondary interest in such groundfish as haddock, cod, white hake, and pollock. The Gloucester whiting-industrial fishery may be said to be based on a whiting economy.

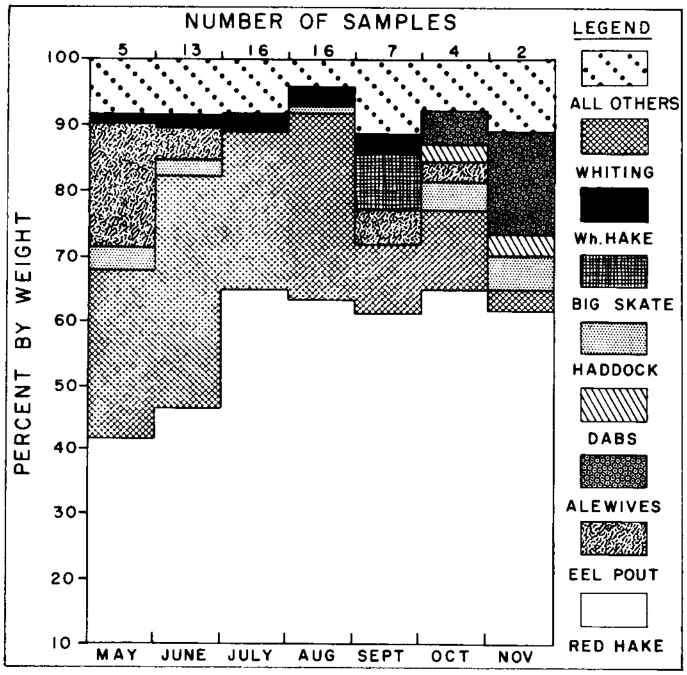

Fig. 2 - Percentage by weight species composition of trawl industrial fish landings at Gloucester from the Nauset area. Data for 1956 and 1957 have been combined.

FISHING AREAS

The trawl industrial fish landed at Gloucester are mainly taken from three grounds (see fig. 1), the Nauset area along Cape Cod's outer shore, Stellwagen Bank, and the local grounds around Cape Ann. The location of the fleet depends upon weather, the season, and the relative abundance of fish, especially whiting. Although the fleet is occasionally found concentrated on the local Gloucester grounds or Stellwagen Bank, the Nauset area contributes 80-90 percent of the total landings. Stellwagen Bank contributes the second largest share, and the local Gloucester grounds contribute the least.

If the demand for trawl industrial fish continues to increase, the amount of fishing on these various grounds will certainly change, and additional areas will be exploited to supply this demand. Concentrations of red hake will be sought in addition to whiting.

Table 2 - Percentage by Weight of Species Composition of the Trawl Industrial Fish Landings at Gloucester from the Three Principal Areas for the Entire Period for Which Information is Available

Species	Area and Period Covered		
	Nauset (May-Nov.)	Stellwagen (June-Jan.)	Gloucester (May-Nov.)
Red hake	57.5	33.8	43.9
Whiting	21.7	39.1	13.3
Eelpout	5.1	1.6	2.6
Alewife	3.4	2.6	9.3
Haddock	2.7	1.8	2.9
Herring	2.7	2.2	2.0
White hake	1.7	1.0	0.8
Big skate	1.6	-	0.5
Spiny dogfish	1.5	1.9	3.0
Dab	1.1	5.1	3.7
Little skate	0.4	0.5	1.0
Longhorn sculpin	0.4	0.3	0.2
Shad	0.3	0.2	2.0
Sea raven	0.3	0.1	-
Barndoor	0.2	0.1	2.2
Fourspot flounder	0.1	-	-
Rockling	0.1	2.1	0.3
Yellowtail	0.1	-	-
Cod	0.1	0.1	0.3
Sea eel	0.1	0.6	-
Ocean perch	0.1	1.2	1.3
Pollock	0.1	0.1	-
All others	0.3	0.5	0.1
Angler	-	4.3	10.2
Blackback		0.1	0.2
Grey sole	-	0.5	0.2
Number of Samples	63	21	20

SPECIES COMPOSITION

The species composition of the landings is presented graphically for each fishing ground (figs. 2-4). Upwards of 20 species may be included in individual catches in significant quantities, depending on the season and the area fished. To keep the graphs reasonably simple, only those species that appear consistently and in some quantity are plotted. The "all others" category on the graphs does not include significant quantities of species of particular interest here.

Figure 2, the percentage by weight of species composition of landings from the Nauset area, indicates that the red hake (Urophycis chuss) makes up the bulk of the fish landed, being approximately 55 percent of the total for the entire period.

The whiting, or silver hake (Merluccius eilinearis), makes up about 22 percent of the landings, with the eelpout (Macrozoarces americanus) ranking as a poor third, or about 5 percent of the total. It should be observed that only three food species (other than whiting), haddock (Melanogrammus aegelefinus), dab (Hippoglossoides platessoides), and white hake (Urophycis tenuis) appear in any number and constitute only a very small part of the landings, in all less than 6 percent.

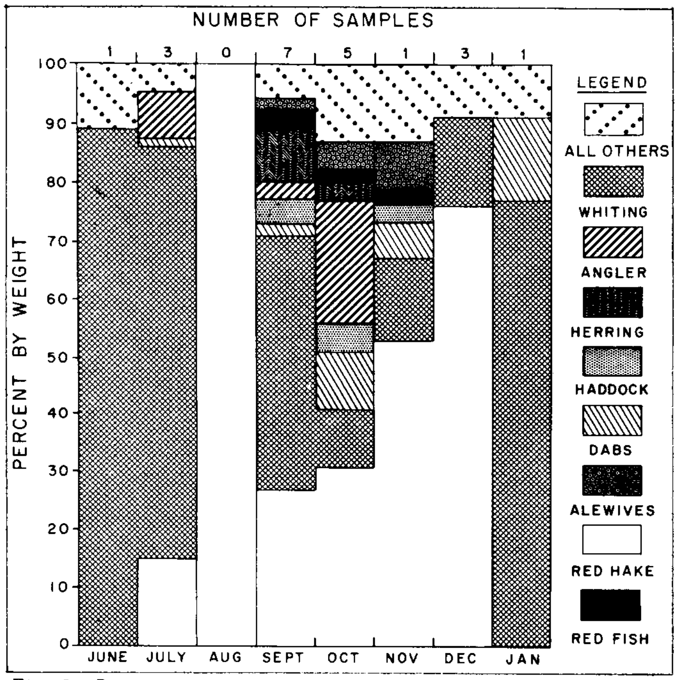

Fig. 3 - Percentage by weight species composition of trawl industrial fish landings at Gloucester from Stellwagen Bank. Data for 1956 and 1957 have been combined.

The composition of the landings from Stellwagen Bank (fig. 3) is quite different. Red hake do not make up the bulk of the landings until fall and early winter in sharp contrast to the other areas. Whiting dominate the catch in the summer and fall. The red hake and whiting together make up approximately 73 percent of the total catch. Dabs are present in significant quantities, making up about 5 percent of the total landings. The white hake and haddock appear consistently but make up a very small part of the total catch.

The local Gloucester grounds, Ipswich Bay, Isle of Shoals, Thatchers (fig. 4), and other nearby fishing grounds present roughly the same picture as that of the Nauset area. Red hake predominate, making up about 45 percent of the total, whiting are second in quantity, contributing about 13 percent to the catch. Angler (Lophius americanus) are in third place, making up about 10 percent of the total. Dabs and haddock together make up a consistent but relatively small (about 6 percent) contribution to the total catch.

Table 3 - Catch per Hour of Trawl Industrial Fish, Round Whiting, and Other Food Fish by the Gloucester Fleet on Nauset Grounds. Data for 1956 and 1957 are Combined

Month	No. of Trips	Catch Per Hour			Average Catch per Trip and Percentage of Total Trip					
		Industrial	Round Whiting	All Other Food Species	Industrial		Round Whiting		All Other Food Species	
		(Pounds)			Lbs.	Percent	Lbs.	Percent	Lbs.	Percent
May	34	1,600	1,450	120	30,900	50.4	27,900	45.5	2,500	4.6
June	31	4,080	2,130	100	46,200	64.6	24,200	33.8	1,100	1.6
July	35	7,720	360	240	78,700	92.4	3,700	4.3	2,800	3.3
August	36	4,930	1,170	50	56,600	80.2	13,400	19.0	600	0.9
September	71	3,050	1,590	180	39,000	63.4	20,300	33.0	2,300	3.7
October	26	2,180	1,130	370	31,300	63.2	14,500	29.4	3,700	7.5
November	38	1,440	890	330	24,600	54.4	15,200	33.5	5,500	12.2

Table 2 lists the percentages by weight of all species landed as trawl industrial fish from each of the three areas discussed. These figures are based on all the samples available and are not weighted according to the landings of individual months. They represent only an approximation, therefore, of the actual breakdown in percentage by weight of the landings.

The species composition picture presented for these grounds differs considerably from that of the landings at New Bedford and Pt. Judith (Edwards and Lux 1938). In southern New England waters, red hake are clearly the predominant species for almost the entire year. On the average, they make up over 60 percent of the entire catch. Whiting rank second, about 20 percent. Little skate (Raja erinacea) and its relatives, big skate (R. ocellata), and the barndoor skate (R. laevis), make up about 10 percent of the total, in sharp contrast to the Gloucester landings.

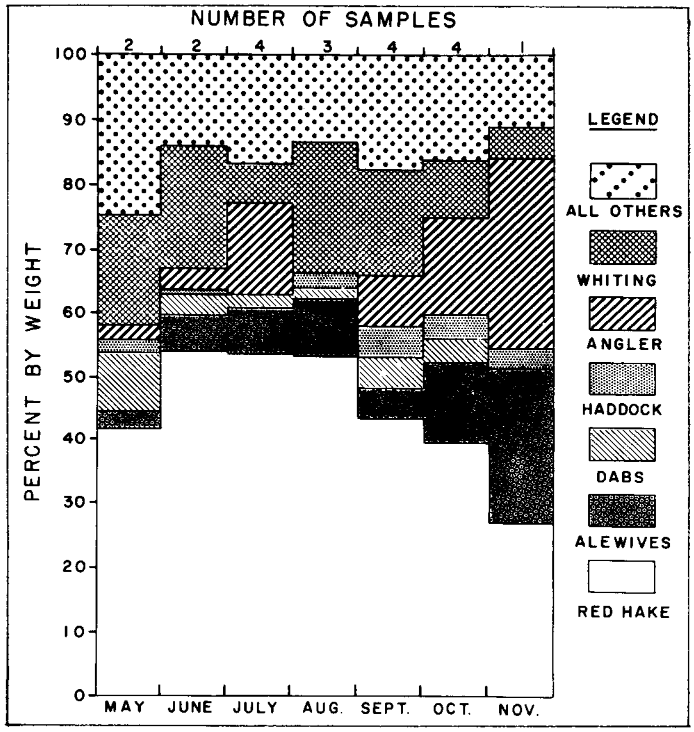

Fig. 4 - Percentage by weight species composition of trawl industrial fish landings at Gloucester from the local Gloucester grounds. Data for 1956 and 1957 have been combined.

ABUNDANCE

Adequate interviewing for abundance studies began in Gloucester early in 1956. The interviewers obtained information for each trip, on the number of tows made and the average length of tow. The catch per unit of effort was obtained by simply dividing the landings by the actual number of hours that the net was fishing. The fleet is made up mostly of vessels with an average gross tonnage of about 50 tons, and no corrections were made (or were felt necessary at this stage) for individual boats, actual vessel size, or gear. Since most of the landings come from the Nauset area, the following discussions will be limited to that area.

Figure 5 shows the seasonal variation in abundance as measured by catch in pounds per hour for the period May through November. All data available for 1956 and 1957 have been combined to elicit the general seasonal pattern. A fisherman may expect to catch about 4,000 pounds per hour in May, with the catch increasing rapidly to over 8,000 pounds per hour in July. The decline in August and early September to about 6,000 pounds per hour is followed by a low level of 2,500 pounds per hour in October and November.

Figure 6 demonstrates that two species, red hake and whiting, account for most of the significant changes observed. The changes in the abundance of red hake are marked and reflect all of the general changes in figure 5. Red hake reach their peak of abundance in July (fig. 6), when the average vessel catch is about 5,000 pounds an hour. Whiting catches of over 3,000 pounds an hour were made in June. In general, whiting are present at levels of at least 1,000 pounds an hour, usually more.

The graph of the catch per hour of whiting (fig. 6) includes both the fish landed for reduction and as human food. Figure 6 also demonstrates that the proportion of whiting landed for reduction is directly related to the abundance of red hake rather than to the whiting's own level of abundance. In figure 6 the industrial portion of the whiting catch expressed in percentage of the total whiting catch is plotted against the catch per hour of red hake. As the catch of red hake increases, it is easier to get a full boatland more quickly, and a fisherman needs to do less culling of fish of higher value to have a successful trip. When "trash fish" are abundant a good trip can be made very quickly. Apparently, the price differential is not sufficient to make it worthwhile for the fishermen to cull out the whiting intensively for the food market under these conditions.

The over-all picture of the Nauset landings is summarized in table 3. Here listed are the statistics on the various portions of the catch for the months of May through November. It should be noted that the number of trips is not the total number made during this period but represents only those trips for which adequate interview data were available to perform the analysis.

Table 4 - Landings of Food Fish by the Gloucester Whiting-Industrial Fish Fleet in September 1956. Total Quantity Landed, Catch Per Hour, and Average Catch Per Trip of Food Species (by Market Category)

Species	Sept. 1-10 15 Trips, 195.5 Hours Fishing			Sept. 1-10 24 Trips, 299.5 Hours Fishing			Sept. 21-30 15 Trips, 242 Hours Fishing			Totals for Month 54 Trips, 737 Hours Fishing		
	Total Landings	Catch per Hour	Trip Average	Total Landings	Catch per Hour	Trip Average	Total Landings	Catch per Hour	Trip Average	Total Landings	Catch per Hour	Trip Average
	.....	(Pounds)	......	....	(Pounds)	......	......	(Pounds)	......	......	(Pounds)	....
Round whiting	148,900	761.6	9,900.0	734,200	2,364.5	30,600.0	357,000	1,477.3	23,800.0	1,240,600	1,683.3	21,700.0
Cod:												
Large	400	2.05	26.7	580	1.9	2.4	360	1.49	24.0	1,340	1.82	24.8
Market	2,675	13.68	178.4	2,425	8.10	101.0	1,850	7.64	123.3	6,950	9.43	128.7
Haddock:												
Large	1,720	8.80	114.7	7,218	24.10	300.8	12,865	53.16	857.7	21,803	29.58	403.8
Scrod	5,650	28.90	376.7	16,205	53.50	675.2	34,265	141.59	2,284.3	56,120	76.15	1,039.3
White hake:												
Large	315	1.61	21.0	30	0.10	1.2	-	-	-	345	0.47	6.4
Market	990	5.06	66.0	2,810	9.38	117.1	2,800	11.57	186.7	6,600	8.96	122.2
Pollock	1,355	6.93	90.3	2,810	9.38	117.1	3,125	12.91	208.3	6,660	9.04	123.3
Gray sole	-	-	-	330	1.10	13.8	3,470	14.34	231.3	3,800	5.16	70.4
Dabs	10	0.05	0.7	560	1.87	23.3	485	2.00	32.3	1,055	1.43	19.5
Yellowtail	125	0.64	8.3	-	-	-	-	-	-	125	0.17	2.3
Butterfish	-	-	-	600	2.00	25.0	250	1.03	16.7	850	1.15	15.7

FOOD-FISH LANDINGS

The month of September 1956 has been chosen to illustrate the nature of the food-fish landings from the Nauset grounds because of an abundance of data and because they illustrate some important problems associated with this fishery. The data were broken down into three periods and are summarized in table 4. The average boat, aside from its industrial catch, lands more whiting than anything else. Various gadoids, haddock, cod, white hake, and pollock make up most of the rest of the food-fish hails. Flounders make up only a small percentage of the total.

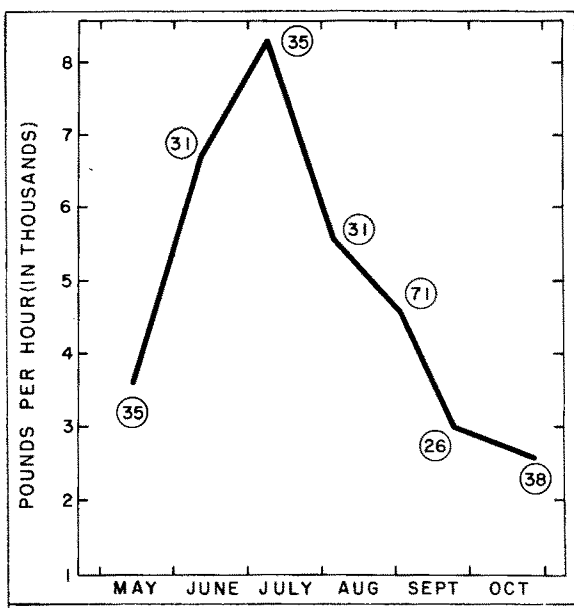

Fig. 5 - Catch per hour of all species on the Nauset grounds for May through November. Number of interviewed trips for each period is circled. Data for 1956 and 1957 have been combined.

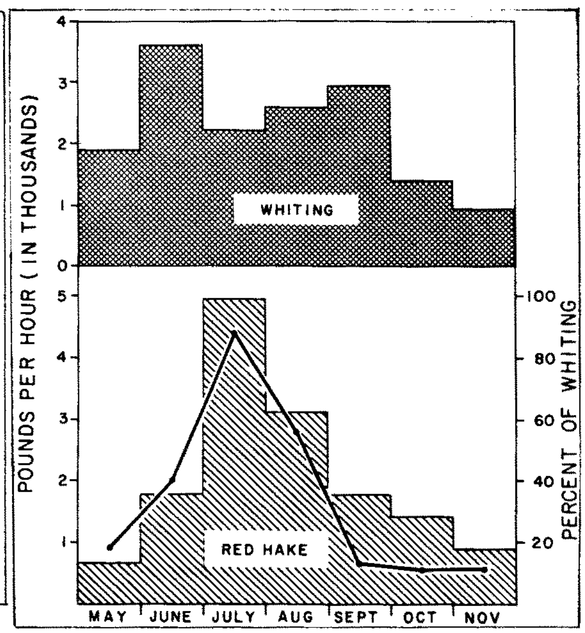

Fig. 6 - Catch in pounds per hour of red hake and whiting in Gloucester landings from the Nauset area. Whiting data are based on the amount landed for reduction plus that landed as food. Data are for May through November. Data for 1956 and 1957 have been combined. Superimposed on the red hake histogram is the graph of the percentage of the total whiting catch sold for reduction.

Landings of both market categories of cod--large and market--decreased during September 1956. The average monthly catch per hour was 9.43 pounds for market, decreasing from 13.68 pounds for the first ten days to 7.64 pounds for the last ten days of the month. While landings of large white hake in September 1956 decreased from a catch per hour of 1.61 pounds to nothing, market hake substantially increased, in fact landings doubled from the first to the last period. A curious fact worthy of further study is the similarity between the catches per hour of the white hake and the pollock. The gray sole and dab catches both substantially increased, while yellowtail flounder was captured only during the first 10-day period.

The amount of whiting landed for reduction by the trawl industrial fleet at Gloucester is directly related to the abundance of red hake rather than to the abundance of whiting itself. This situation is probably caused by the relatively small price differential between whiting and industrial fish.

The trawl industrial fishery also lands various groundfish for the food market, including haddock, cod, white hake, pollock, dab, yellowtail, and gray sole.

Only small percentages of valuable food species are going to the reduction plants at this time. An expansion of Gloucester's trawl industrial fishery should be possible without foreseeable undue impact on the stocks of valuable food species, considering present practices. The whiting is a possible exception to this since it is in demand for both food and reduction.

The data for haddock are particularly interesting, the catch per hour increasing markedly for both categories. During the last 10-day period the average trip of the two market categories of haddock combined was in excess of 3,000 pounds, in contrast to only 500 pounds during the first 10 days.

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1958. New England's Industrial Fishery. Commercial Fisheries Review, vol. 20, No.5 (May), pp. 1-6.
(Also Separate No. 509.)

CRUISE SCHEDULES AND CRUISE RECORDS

This report contains the cruise schedules of the _Albatross III_ (1948 - 1959), _Delaware_ (1951, 1959, 1960), _T - 79_ (1956 - 1958), and commercial charters (1952 - 1959).

All the data available from each cruise are tabulated on a check list.

Prepared by:
Samuel R. Nickerson
Marine Technician

SCHEDULE OF ALBATROSS III CRUISES
Numbers 1-128, May 1948 to Feb. 19, 1959

Cruise No.	Dates	Purpose of Cruise and Area Covered	Chief of Party
1	May 17-20	Study of effects of waste disposal off New York (National Research Council contract)	Royce
2	May 25-27	Tagging yellowtail flounders north along Cape Cod and in Cape Cod Bay	Royce
3	June 7-10	To test, by tagging, survival of haddock which pass through meshes of savings cod end. Georges Bank	Webster
4	June 21-29	To test, by tagging, survival of haddock which pass through meshes of savings cod end and to compare efficiency of a standard commercial otter trawl with rollers and V-D gear and a modified trawl without rollers and V-D gear. Georges Bank	Webster
5	July 13-21	Census of groundfish populations on Georges Bank	Royce
6	July 28-Aug. 5	Census of groundfish populations on southern New England banks and to test new oceanographic instruments with cooperating WHOI scientists	Royce
7	Aug. 5-25	Census of groundfish populations on Georges Bank	Webster
8	September 1	Demonstration Cruise, Woods Hole	
9	Sept. 8-10	Census of groundfish populations in South Channel area and experiments on the refrigeration of fish at sea	Webster
10	Sept. 29-Oct. 6	Census of groundfish populations in South Channel area	Webster

Cruise No.	Dates	Purpose of Cruise and Area Covered	Chief of Party
	1948		
11	Oct. 14-19	Census of groundfish populations in South Channel area	Webster
12	Oct. 28-Nov. 6	Census of groundfish populations on the southern New England banks, tests of hydrographic gear by WHOI personnel, continuation of the study of the effect of waste acid disposal off New York City	Royce
13	Nov. 18-19	To test action of double-trousered trawl and to compare size selectivity of 4-5/8" stretched mesh and regular commercial mesh. Western side of South Channel	Stringer
14	Dec. 1-9	Census of groundfish populations in the west central part of the Gulf of Maine	Webster
	1949		
15	Jan. 10-13	To test action of double-trousered trawl and to undertake mesh selectivity experiments. Western side of South Channel	Stringer
16	Jan. 17-19	To test action of double-trousered trawl and to undertake mesh selectivity experiments. Western side of South Channel	Stringer
17	Feb. 28	To measure horizontal and vertical of census net. Falmouth outer harbor	Royce
18	May 17-21	To determine distribution of temperature, salinity, and density between Cape Hatteras and Cape Lookout (Cooperative agreement with the Univ. of North Carolina Institute of Fisheries Research)	Royce
19	May 24-June 3	Census of groundfish populations and hydrographic survey of area between Cape Lookout and Cape Fear (Cooperative agreement with the Univ. of North Carolina Institute of Fisheries Research)	Buller

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1949		
20	June 7	Demonstration cruise out of Moorhead City, N. C.	
21	June 8-12	To determine the distribution of shrimp eggs and larvae and fish and make a hydrographic survey in the area between Cape Lookout and Cape Fear	Royce
22	June 14-17	Census of groundfish populations and hydrographic survey area between Cape Lookout and Cape Hatteras	Royce
23	June 23-29	Mesh selectivity studies and tagging experiments on Georges and Browns Banks	Schuck
24	July 11-19	Mesh selectivity studies and underwater camera experiments by WHOI personnel. Georges Bank and South Channel	Stringer
25	July 25	Demonstration Cruise	
26	July 27-Aug. 5	Census of groundfish populations on Georges Bank	Buller
27	Aug. 11-15	Census of groundfish populations, South Channel, Cape Cod Bay, and southern New England banks	Buller
28	Sept. 7-16	Census of groundfish populations in the Gulf of Maine	Buller
29	Sept. 23-29	Mesh selectivity experiments on haddock and redfish. Georges Bank and Gulf of Maine	Stringer
	1950		
30	Jan. 4-13	Hydrographic survey of continental shelf between Long Island, N. Y., and Little River Inlet, N. C. (In cooperation with WHOI and Univ. of North Carolina)	Royce

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1950		
31A	Jan. 16-24	To determine trawlability of bottom and availability of food fish on the continental shelf between Cape Fear and Cape Lookout (Cooperative Agreement with the Univ. of North Carolina)	Buller
31B	Jan. 16-24		Buller
31C	Feb. 6-12		Arnold
31D	Feb. 25-Mar. 6		Arnold
32	Feb. 25-Mar. 6	Hydrographic survey of area between Little River Inlet and Oregon Inlet (Cooperative agreement with the Univ. of North Carolina)	Arnold
33	Mar. 15-30	Census of groundfish populations on Georges Bank	Buller
34	Apr. 24-May 5	Exploratory fishing and census of groundfish populations on the western Nova Scotian Banks	Royce
35	May 11-18	Census of groundfish populations with special study of fluke and yellowtail flounders near the continental edge of Southern New England. (Cooperative project with WHOI)	Schroeder
36	June 6-23	"Operation Cabot" Gulf Stream Study (Cooperative project, U. S. Navy, WHOI, Canadian Research Establishment, FWS, Scripps Inst. of Oceanog.)	Colton
37	July 6-12	Census of groundfish populations on Georges Bank	Royce
37A	July 31-Aug. 10	Census of groundfish populations on Georges Bank, Browns Bank, and the Gulf of Maine	Buller
38	Aug. 21-31	Census of groundfish populations, South Channel and Southern New England banks. Studies of the gas content in the swim bladder (WHOI personnel)	Buller
39	Sept. 6-15	Tagging of scrod and large-sized haddock on Georges and western Nova Scotian Banks	Schuck

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
40-44	Feb. 9, 1951 to June 25, 1952	Operating under ONR contract for WHOI (Jezebel Program #8961)	
	June 1952 to Feb. 1953	Jezebel Program #8961 (operating out of Bayonne, N. J.; to Bermuda, Morehead City, N. C.	
	1953		
45	Mar. 3-11	To study vertical and horizontal distribution of redfish in the Gulf of Maine	Kelly
46	Mar. 19-Apr. 2	To determine the distribution of haddock eggs and larvae, temperature, and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank Area	Colton
47A	Apr. 9-13	To determine the characteristics of a fish school: area, density, and relation to the bottom, Georges Bank	Taylor
47B	Apr. 15-21	- - - - - -do - - - - - - - -	Taylor
48	Apr. 24-May 6	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
49	May 14-21	Mesh selectivity experiments on haddock. Southeast and southwest parts of Georges Bank	Clark
50	May 25-June 3	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
51	June 8-17	Mesh selectivity experiments on haddock. Vicinity of Jeffries Ledge, Gulf of Maine; Southeast part of Georges Bank	Clark
52	July 20-29	Mesh selectivity experiments on haddock. Southeast and southwest parts of Georges Bank	Clark

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1953		
53	Aug. 10-21	Studies of the distribution of redfish in the Gulf of Maine, southern edge of Georges Bank and Nantucket Shoals	Kelly
54	Sept. 1-14	Studies of the distribution of pre-recruit haddock in the Gulf of Maine-Georges Bank area	Colton
55	Sept. 22-25	Studies of the distribution of pre-recruit haddock on the Southern New England Banks	Colton
	Sept. 26, 1953 to Jan. 31, 1955	Laid up for lack of funds	
	1955		
56	Feb. 1-13	Studies of the distribution of groundfish on Georges Bank	Clark
57	Feb. 21-Mar. 9	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
58	Mar. 19-Apr. 1	- - - - - - - do - - - - - - - - - -	Colton
59	April 6-12	Mesh selectivity studies LaHave Bank	Clark
60	April 19-May 3	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Marak
61	May 16-28	- - - - - - do - - - - - - - - - - -	Colton
62	June 6-18	Studies of the distribution of groundfish on Georges and Browns Banks	Clark
63	Aug. 15-19	Studies of the horizontal and vertical distribution of redfish in the Gulf of Maine and South Channel	Kelly
64	Aug. 23-Sept. 2	Mesh selectivity studies. Sable Island	Clark

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1955		
65	Sept. 7-16	Studies of the distribution of prerecruit haddock in the Gulf of Maine-Georges Bank area	Colton
66	Sept. 21-28	Studies of the distribution of prerecruit haddock on Georges and the southern New England banks	Colton
67	Oct. 3-5	Experiment with 6 types of bottom samplers. South of Martha's Vineyard	Wigley
68	Oct. 12-28	Mesh selectivity studies. Joint cruise with <u>Delaware</u>. Georges Bank	Clark
69	Nov. 15-23	Bottom survey to sample benthic fauna on southern part of Georges Bank and Nantucket Shoals.	Wigley
70	Dec. 6-19	Bottom survey of benthic fauna and to tag scallops on southern part of Georges Bank and Nantucket Shoals	Wigley
	1956		
71	Feb. 20-Mar. 2	To determine the distribution of haddock eggs and larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Marak
72	Mar. 21-31	---------do---------	Colton
73	April 17-28	---------do---------	Colton
74	May 2-10	Mesh selectivity studies, Georges Bank	Clark
75	May 16-29	To determine the distribution of haddock eggs and larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
76	June 11-24	---------do---------	Marak
77	July 5-11	Survey of sea scallop beds on Georges Bank	Posgay

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1956		
78	July 16-17	Underwater TV testing, Buzzards Bay	Clark
79	July 23-Aug. 4	Mesh selectivity studies with Delaware (#23), Georges Bank	Clark
80	Aug. 9-17	Bottom survey of benthic fauna on Georges Bank	Wigley
81	Nov. 2-10	Studies of the distribution of pre-recruit haddock and whiting in the Gulf of Maine-Georges Bank area and the southern New England banks	Conover
82	Nov. 13-21	---------do---------	Conover
83	Nov. 27-30	Studies of the behavior and escapement of fish through the cod end of a commercial otter trawl with UTV. Provincetown, Cape Cod Bay, and No Man's	Livingstone
84	Dec. 6-14	Codfish and haddock tagging. Georges Bank	Wise
85	Dec. 19-20	Comparison of SMBA (CPS Emitron) and USFWS (Image-Orthicon) UTV equipment. Vicinity of Woods Hole	Livingstone
	1957		
86	Jan. 21-23	Studies of the mid-water distribution of red hake in respect to depth and temperature. South of Martha's Vineyard	Edwards
87	Jan. 30-Feb. 2	To study the behavior of trawl-caught haddock with UTV. Georges Bank	Livingstone
88	Feb. 19-28	To determine the distribution of herring larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine, Georges Bank and Bay of Fundy area	Farrin
89	Mar. 21-Apr. 5	To test the efficiency of various tags to tag cod, and study groundfish behavior with UTV. Georges Bank, Browns Bank	Livingstone
90	April 11-17	To study in detail the nontidal drift pattern on Georges Bank with relation to the drift of haddock eggs and larvae	Colton

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1957		
91	Apr. 22-23	To test and calibrate 601b multiplane kite-otter. South of Martha's Vineyard	Colton
92	Apr. 25-May 2	To study in detail the nontidal drift pattern on Georges Bank with relation to the drift of haddock eggs and larvae	Colton
93	May 8-16	---------do---------	Marak
94	May 22-29	---------do---------	Colton
95	June 5-12	---------do---------	Colton
96	June 19-26	Study of the behavior of fish with UTV Cape Cod Bay and South Channel	Livingstone
97	July 10-13	To study the behavior of whiting in trawls with UTV. South Channel	Clark
98	July 14-19	Silver hake tagging northwest of the Cultivator whistle buoy	Fritz
99	July 25-Aug. 2	Vertical distribution of redfish and haddock fry in the Gulf of Maine	Kelly
100	Aug. 15	Demonstration Cruise out of Boston	
101	Aug. 21-30	Bottom survey of benthic fauna on Georges Bank, South Channel and Browns Bank	Wigley
102	Sept. 5-11	Vertical distribution of postlarval redfish in Gulf of Maine	Kelly
103	Sept. 18-26	Dredging, tagging, and observing spawning of sea scallops. Georges Bank	Posgay
104	Oct. 9-20	Haddock and cod tagging on Georges and Browns Banks	Jensen
105	Oct. 28-Nov. 8	Haddock and cod tagging in the Gulf of Maine and on Browns Bank	Wise
106	Dec. 3-20	To determine the distribution of herring larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine, Georges Bank and Bay of Fundy area	Temple

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1958		
107	Jan. 7-24	To determine the distribution of herring larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine, Georges Bank and Bay of Fundy area	Temple
108	Mar. 26-Apr. 9	To tag haddock and occupy IGY hydrographic section. Georges and Browns Banks	Jensen
109	Apr. 21-25	To study the behavior of fish and use of UTV for estimating population sizes of fish. Cape Cod fishing grounds	Livingstone
110	Apr. 30-May 8	Testing new high-speed sampler and calibration trials of multiplane kite-otter. Georges Bank	Marak
111	May 19-28	To study vertical distribution of fish eggs and larvae. Georges Bank	Colton
112	June 9-13	Studies of the behavior and orientation of groundfish with UTV. Stellwagen Bank and Massachusetts Bay	Livingstone
113	June 19-26	Sea scallop tagging and bottom photography. Georges Bank	Posgay
114	July 7-16	Whiting tagging. Georges Bank and New England Coast.	Fritz
115	July 23	Demonstration Cruise out of Boston Stellwagen Bank	
116	Jul. 28-Aug. 1	Study the vertical distribution of postlarval redfish in the southwest part of the Gulf of Maine.	Kelly
117	Sept. 9-16	Study the vertical distribution of redfish and occupy IGY hydrographic section. Georges Bank, Browns Bank, and southwest part of Gulf of Maine	Kelly
118	Sept. 22-Oct. 2	Studies of the distribution of prerecruit haddock in the Gulf of Maine-Georges Bank area	Colton
119	Oct. 6-17	Studies of the distribution of prerecruit haddock on Georges Bank	Marak

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1958		
120	Oct. 20-28	Studies of the distribution of prerecruit haddock on the southern New England banks	Colton
121	Nov. 4-7	To test current and temperature instrumentation used in conjunction with UTV. Cape Cod Bay	Livingstone
122	Nov. 17-26	Haddock tagging and populations studies on the Highland Grounds east of Stellwagen Bank and Cape Cod	Clark
123	Dec. 4-11	Sampling silver hake and yellowtail flounder south of Martha's Vineyard and off Nauset Light and Bell Telephone exercise	Fritz
124A	Dec. 13	To test high-speed plankton sampler. Southeast of Block Island	Miller
124B	Dec. 16-17	To test bottom fauna sampler and evaluate efficiency of the naturalist's dredge. Vineyard Sound and Buzzards Bay	Wigley
	1959		
125	Jan. 13-15	Industrial fish survey off Block Island Sound	Fritz
126	Jan. 21-Feb. 4	To study the role of temperature in fish distribution. Cape Cod to Cape Hatteras	Edwards
127	Feb. 10-11	To recover recording buoy on Georges Bank	Hiller
128	Feb. 15-20	Bell Telephone Laboratory Exercise	Hiller
	Feb. 27	Departed Woods Hole for East Boston for lay up.	

SCHEDULE OF DELAWARE CRUISES

Fiscal Years 1959 and 1960

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1959		
59-3	Mar. 18-27	To catch yellowtail flounder for tagging. South of Martha's Vineyard to south of Block Island	Lux
59-4	Apr. 2-17	To determine vertical distribution of spawning haddock. Browns shoals	Clark
59-9	Aug. 6-12	Obtaining samples of substrates for benthic fauna. Southern Gulf of Maine and Browns Bank	Wigley
59-12	Sept. 23-Oct. 7	Studying the distribution of young-of-year and older haddock. Browns and Georges Banks, and the Gulf of Maine	Wise
59-13	Oct. 13-27	Studying the distribution of young-of-year and older haddock. Browns and Georges Banks, Gulf of Maine and the offing of New York	Jensen
59-14	Dec. 1-10	Survey techniques. Southeast of Martha's Vineyard	Fritz
	1960		
60-2	Feb. 10-29	Conduct hydrographic and fishing survey. Continental Shelf from Martha's Vineyard to Cape Hatteras	Fritz
60-3	Mar. 8-19	Conduct a fishing survey and determine the vertical movements of the silver and American hake. Continental Shelf along the eastern side of Georges Bank	Skerry
60-4	Mar. 23-Apr. 3	Conduct a survey of the spawning habits of haddock. Georges and Browns Banks	Wise
60-5	Apr. 6-12	To collect adult haddock and haddock eggs and to make designated bathythermograph transects. Georges and Browns Banks	Wheeler
60-7	May 11-22	Survey techniques. South of Block Island to Cape Hatteras	Merrill
60-8	May 23-29	To compile data relating to the population structure and density of the sea scallop beds. Georges Bank	Posgay

SCHEDULE OF DELAWARE CRUISES

Fiscal Years 1959 and 1960

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1960		
60-10	July 5-9	This cruise, the first of a series, is a survey of the inshore distribution and the possible incidental take of young-of-the-year and 1-year-old haddock by the whiting and industrial fishing fleets. Area between Cape Ann and Isles of Shoals, Stellwagen Bank, and area off Nauset Beach.	Fritz
60-12	May 2-21	To determine the distribution and relative abundance of young-of-the-year haddock and other fishes occurring in the Gulf of Maine, Georges Bank, and Browns Bank	Skerry
	1961		
61-4	Mar. 16-27	To investigate the vertical movements of silver and American hake east of Delaware Bay	Fritz
61-5	Mar. 30-Apr. 7	To tag fluke in an area between Veatch and Hudson Canyons in 50 to 80 fathoms of water	Lux
61-7	May 3-10	To collect quantitative length-frequency samples of the sea scallop population. Georges Bank	Merrill
61-9	June 12-16	Inshore haddock survey between Isles of Shoals, Stellwagen Bank, and Nauset	Fritz
61-10	June 20-30	Obtain samples of bottom sediments and benthic fauna. Central and northern portions of the Gulf of Maine	Wigley
61-12	July 20-Aug. 3	To conduct whiting selection experiments. Ipswich Bay, Stellwagen Bank, Nauset	Fritz
61-13	Aug. 10-19	To perform scallop gear selection experiments. Georges Bank	Merrill

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1961		
61-16	Sept. 22-30	To collect data on abundance and distribution of sea scallops. Georges Bank	Posgay
61-17	Oct. 3-6	To conduct a groundfish survey on the northern edge at Georges Bank	Fritz
61-19	Oct. 25-Nov. 6 Nov. 8 -20	To determine distribution and abundance of young-of-the-year haddock and other fishes from Bay of Fundy south to Hudson Canyon.	Fritz Miller
	1962		
62-3	Mar. 15-22	To conduct a serological survey at selected stations from Massachusetts Bay to Browns Bank via Nauset and Georges Bank	Cumming
62-6	May 28-June 6	To collect data on the distribution and abundance of sea scallops. Georges Bank	Merrill
62-7	June 11-20	To sample the benthic fauna and bottom sediments at designated localities in Great South Channel, Georges Bank, and the region south of Nantucket and Marthas Vineyard	Wigley
62-8	June 25-28	Collect live specimens of the common offshore species for aquarium exhibits. To make a groundfish survey south of Marthas Vineyard.	Wheeler Fritz
62-10	Sept. 11-20	To collect data on distribution and abundance of sea scallops on Georges Bank	Merrill
62-12	Oct. 9-20	To determine distribution and abundance of young-of-the-year haddock and other fishes from the Bay of Fundy southward to Hudson Canyon.	Fritz
62-13	Oct. 25-Nov. 4	------ do ----------	Jensen

CRUISE RECORDS

Cruise No.	Sailing Order	Supple-ment	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Albatross III									
1	X	X	X	O	X	X	O	O	O
2	X	X	X	O	X	X	O	O	O
3	X	X	O	O	X	X	O	O	O
4	X	X	X	O	X	X	O	O	O
5	X	X	X	O	X	X	O	O	X
6	X	X	X	O	X	X	O	O	X
7	X	X	X	O	X	X	O	O	X
8	X	X	X	O	Dem. Cr.	O	O	O	O
9	X	X	X	O	X	O	O	O	X
10	X	X	X	O	X	X	O	O	O
11	X	X	X	O	X	X	O	O	X
12	X	X	X	X	X	X	O	O	X
13	X	X	X	O	X	O	O	O	X
14	X	X	X	O	X	O	O	O	X
15	X	X	X	X	X	O	O	O	X
16	X	X	X	X	X	O	O	O	X
17	X	X	O	O	O	O	O	O	O
18	X	X	X	X	X	WHOI	X	O	O
19	X	X	X	O	X	WHOI	X	O	O
20	X	X	X	O	Dem. Cr.	WHOI	X	O	O
21	X	X	X	O	X	WHOI	X	O	O
22	X	X	X	O	X	WHOI	X	O	O
23	X	X	X	O	X	WHOI	X	O	X
24	X	X	X	O	X	O	O	O	O
25	X	X	X	O	Dem. Cr.	O	O	O	O
26	X	X	X	O	X	X	X	O	X
27	X	X	X	O	X	X	X	O	X
28	X	X	X	O	X	X	X	O	X
29	X	X	X	O	X	O	O	O	O
30	O	X	O	O	O	WHOI	X	O	O
31A	X	X	X	O	X	WHOI	X	O	O
31B	X	X	X	O	X	WHOI	X	O	O
31C	X	X	X	O	X	WHOI	X	O	O
31D	X	X	X	O	X	WHOI	O	O	O
32	X	X	X	O	O	WHOI	X	O	O
33	X	X	X	O	X	X	X	O	O
34	X	X	X	O	X	X	O	O	O
35	X	X	X	O	X	X	X	O	O
36	X	X	X	O	O	X	O	O	O
37	X	X	X	O	X	X	O	O	O
37A	X	X	O	O	X	X	X	O	O
38	X	X	X	O	X	X	X	O	O
39	X	X	X	O	X	O	O	O	O
Delaware									
1	X	X	X	O	O	O	O	O	O
2	X	X	X	O	X	X	O	O	O
3	X	X	X	O	X	X	O	O	O

CRUISE RECORDS (Continued)

Cruise No.	Sailing Order	Supplement	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Albatross III									
40-44	Operating for WHOI					WHOI			
45	X	X	X	O	X	X	O	O	O
46	X	X	X	X	O	X	O	O	O
47A	X	X	X	X	O	X	O	O	O
47B	X	X	X	X	O	X	O	O	O
48	X	X	X	O	O	X	O	O	O
49	X	X	X	O	O	X	O	O	O
50	X	X	X	O	O	X	O	O	O
51	X	O	X	O	O	WHOI	O	O	O
51A	O	O	O	O	X	WHOI	O	O	O
52	X	O	X	O	O	WHOI	O	O	O
53	X	X	X	O	X	WHOI	O	O	O
54	X	X	X	O	X	X	O	O	O
55	X	X	X	O	X	X	O	O	O
56	X	X	X	O	X	X	O	O	O
57	X	X	X	O	O	X	O	O	O
58	X	X	X	O	O	X	O	O	O
59	X	X	X	O	O	O	O	O	O
60	X	X	X	O	O	X	O	O	O
61	X	X	X	O	O	X	O	O	O
62	X	X	X	O	X	X	O	O	O
63	X	X	X	O	X	X	O	O	O
64	X	X	X	O	O	O	O	O	O
65	X	X	X	O	X	X	O	O	O
66	X	X	X	O	X	X	O	O	O
67	X	X	X	O	O	O	O	O	O
68	X	X	X	O	O	O	O	O	O
69	X	X	X	O	O	X	O	O	O
70	X	X	X	O	O	X	O	O	O
71	X	X	X	O	O	X	O	O	O
72	X	X	X	O	O	X	O	O	O
73	X	X	X	O	O	X	O	O	O
74	X	X	X	O	O	O	O	O	O
75	X	X	X	O	O	X	O	O	O
76	X	X	X	O	O	X	O	O	O
77	X	X	X	O	O	X	O	O	O
78	X	O	X	O	O	O	O	O	O
79	X	X	X	O	O	O	O	O	O
80	X	X	X	O	O	X	O	O	O
81	X	X	X	O	X	X	O	O	O
82	X	X	X	O	X	X	O	O	O
83	X	O	X	O	O	O	O	O	X
84	X	O	X	O	O	O	O	O	X
85	X	O	X	O	O	O	O	O	O
86	X	O	X	O	O	X	O	O	X
87	X	X	X	O	O	X	O	O	O
88	X	X	X	O	O	X	O	O	X
89	X	X	X	O	X	X	O	O	X
90	X	X	X	O	O	X	O	O	O

CRUISE RECORDS (Continued)

Cruise No.	Sailing Order	Supple- ment	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Albatross III									
91	X	X	X	O	O	X	O	O	O
92	X	X	X	X	O	X	O	O	O
93	X	X	X	O	O	X	O	O	O
94	X	X	X	O	O	X	O	O	O
95	X	X	X	O	O	X	O	O	O
96	X	O	X	O	O	O	O	O	O
97	X	O	X	O	O	O	O	O	X
98	X	O	X	O	O	O	O	O	X
99	X	X	X	O	X	X	O	O	X
100	X	X	X	O	Dem. Cr.	O	O	O	O
101	X	O	X	O	O	O	O	O	O
102	X	X	X	O	X	X	O	O	O
103	X	O	X	O	O	X	O	O	O
104	X	X	X	O	X	X	O	O	O
105	X	X	X	O	X	X	O	O	O
106	X	X	X	O	O	X	O	O	O
107	X	X	X	X	O	X	O	O	O
108	X	X	X	O	X	X	O	O	O
109	X	X	X	X	O	X	O	O	O
110	X	X	X	O	O	X	O	O	O
111	X	X	X	O	O	X	O	O	O
112	X	X	X	O	O	X	O	O	O
113	X	X	X	O	O	X	O	O	O
114	X	X	X	O	X	X	O	O	X
115	X	X	X	O	Dem. Cr.	O	O	O	O
116	X	X	X	O	X	X	O	O	X
117	X	X	X	O	X	X	O	O	X
118	X	X	O	X	X	X	O	O	X
119	X	X	O	X	X	X	O	O	X
120	X	X	O	X	X	X	O	O	X
121	X	X	X	O	O	X	O	O	X
122	X	X	X	O	O	X	O	O	O
123	X	X	X	O	X	X	O	O	O
124	X	O	X	O	O	O	O	O	O
125	X	X	X	O	X	X	O	O	O
126	X	X	X	O	X	X	O	O	X
127	X	O	O	O	O	X	O	O	O
128	X	X	O	O	O	X	O	O	O
Delaware									
59-3	X	X	X	O	O	X	O	O	O
59-4	X	X	O	O	O	X	O	O	O
59-9	X	O	X	O	O	X	O	O	O
59-12	X	X	X	O	X	X	O	O	O
59-13	X	X	X	O	X	X	O	O	O
59-14	X	X	X	X	X	X	O	O	O

CRUISE RECORDS (Continued)

Cruise No.	Sailing Order	Supple-ment	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Delaware									
60-2	X	X	X	O	X	X	O	O	O
60-3	X	X	X	O	X	X	O	O	O
60-4	X	X	X	O	X	X	O	O	O
60-5	X	O	X	O	X	X	O	O	O
60-7	X	X	X	O	O	X	O	O	O
60-8	X	X	X	O	O	X	O	O	O
60-10	X	X	X	X	X	X	O	X	X

Key: X = Available; O = Missing.

Cruise Schedule for

COMMERCIAL CHARTERS AND T-79

Vessel	Dates	Purpose	Chief of Party
	1952		
We Three	May 6	To sample small redfish with a Petersen small fish trawl, a line trawl, and a gill net in the area East of Cape Porpoise in 60 fathoms	Kelly
Michigan	June 4-12	To determine the selectivity of sizes of haddock by an otter trawl of various mesh sizes. Georges Bank	Clark
Michigan	June 15-23	- - - - - do - - - - - - - -	Clark
U. S. Fish & Wildlife Launch	Sept. 10-12	To fish experimentally for small redfish and handline for large redfish in the deep water off Gloucester harbor	Kelly
Caryn	Oct. 2-3	To trawl with a fine mesh net (1/4" square) for scattering layer organisms and for young redfish. South of Marthas Vineyard, 70-100 fathoms	Kelly
Wisconsin	Oct. 14-23	To determine the selectivity of sizes of haddock by an otter trawl of various mesh sizes. Georges Bank	Clark
	1953		
Cap'n Bill II	July 10-17	Exploratory fishing on the edge of the Continental Shelf to determine the fauna present in the 200 fathom to 700 fathom depths. Block Island to Corsair Canyon	W. Schroeder
Priscilla V 1	Nov. 9-11	To sample young-of-the-year redfish from New Scrantum station 25 miles east of Gloucester for validation of otolith year zones.	Kelly

Vessel	Dates	Purpose	Chief of Party
	1954		
Priscilla V 2	Feb. 5-8	- - - - - do - - - - - - - - -	Kelly
Priscilla V 3	Apr. 20-23	- - - - - do - - - - - - - - -	Kelly
Priscilla V 4	Aug. 3-10	- - - - - do - - - - - - - - -	Kelly
Priscilla V 5	Sept. 13- Nov. 2	Whiting mesh selection Cape Cod Bay and Jeffrey's Ledge	Clark
Priscilla V 6	Nov. 17-23	Redfish mesh selection. Cashes Ledge	Clark
	1955	No charters	
	1956		
Huckleberry Finn William Cheesebrough	Oct. 29- Nov. 1	To observe the behavior of fish while being captured by an otter trawl in the Amagansett area off Long Island, New York	Livingstone
	1957		
Canadian R./V. Harengus	May 15-18	To recapture redfish tagged at Eastport, Maine, between Grand Manan and Campobello Island	Kelly
Whaling 1 City	June 13-23	To test the relative efficiency of scallop dredges with 2", 3", 3 1/2", and 4" rings in the bag and to determine the selection points of the various ring sizes. Cultivator and Northeast Peak	Posgay
Whaling 2 City	Aug. 8-17	To develop gear selection curves for scallop dredges with 3", 3 1/2", and 4" rings. Georges Bank	Posgay
	1958		
Jacquelyn 1	May 21	A series of cruises to obtain periodic data for life history studies of industrial fish and sea scallops around Block Island	Edwards

Vessel	Dates	Purpose	Chief of Party
	1958		
Jacquelyn 2	June 12	- - - - - do - - - - - -	Edwards
Jacquelyn 3	July 18	To sample at the regular fishing and scallop stations.	Merrill
Jacquelyn 4	Aug. 18	To sample at the regular fishing and scallop stations.	Merrill
Jacquelyn 5	Sept. 23	To census scallop and fish populations and to take samples of this material for detailed study at the Woods Hole Laboratory.	Edwards
Dartmouth	Sept. 9-16	To compare selectivity of scallop dredges made of 3, and 3 1/2, and 4 inch rings (inside diameter) with 2 inch I. D. dredge. Census scallop stocks, test metered roller and make spawning observations. Georges Bank	Nichy
	1959		
Whaling 3 City	May 13-20	To collect length frequency and age frequency samples from the Georges Bank sea scallop beds.	Posgay
Whaling 4 City	Sept. 12-18	- - - - - do - - - - - -	Merrill
	1960		
Cap'n 1 Bill III	Aug. 22-26	Inshore haddock survey between Isle of Shoals, Stellwegen Bank, and Nauset	Skerry
Cap'n 2 Bill III	Sept. 19-23	- - - - - do - - - - - -	Skerry
Noah A 1	Sept. 30	To census a scallop population and take samples for analysis at Woods Hole Laboratory. Three miles northwest of Billingsgate Buoy, Cape Cod Bay	Merrill

Vessel	Dates	Purpose	Chief of Party
	1960		
Noah A 2	Oct. 9	To check spawning and bring back unspawned scallops to Laboratory for experiments and to make underwater observations on the efficiency of scallop gear. Three miles northwest of Billingsgate Buoy, Cape Cod Bay	Merrill
Noah A 3	Oct. 23	To check sea scallop spawning, to observe and take underwater motion pictures of the operation of sea scallop gear. Three miles north of Sandy Neck, Cape Cod Bay	Merrill
Noah A 4	Nov. 13	To check spawning, and to perform experiments to determine the efficiency of scallop gear. Three miles northwest of Billingsgate Buoy, Cape Cod Bay	Merrill
	1961		
Charlotte 1	Sept. 1	To locate beds of scallops in sufficient quantities for later experiments on scallop gear efficiency. Two to five miles northwest of Sandwich, Mass.	Merrill
Charlotte 2	Oct. 16	To check the spawning of the sea scallop. Two to five miles northwest of Sandwich, Mass.	Merrill
Charlotte 3	Nov. 14	To check the spawning of the sea scallop. Two to five miles northwest of Sandwich, Mass.	Merrill
	1962		
Charlotte 4	Jan. 16	To obtain live scallops for laboratory tank experiments; to observe gonad development of sea scallops. Two to four miles northwest of Sandwich, Mass.	Haynes
Charlotte 5	April 7	- - - - - do - - - - - -	Haynes

MONTHLY HADDOCK CRUISES

Silver Mink and Shirley-Roland

High Grounds NNE of Cape Cod Light

Cruise No.	Date	Purpose	Chief of Party
1	Feb. 12, 1958	To make observations and collect data for haddock ecology study	Clark
2	Mar. 9, 1958	- - - - - do - - - - - -	Clark
3	Apr. 11, 1958	- - - - - do - - - - - -	Clark
4	May 12, 1958	- - - - - do - - - - - -	Jensen
5	June 8, 1958	- - - - - do - - - - - -	Jensen
6	July 12, 1958	- - - - - do - - - - - -	Jensen
7	Aug. 9, 1958	- - - - - do - - - - - -	Clark
8	Sept. 14, 1958	- - - - - do - - - - - -	Clark
9	Oct. 14, 1958	- - - - - do - - - - - -	Jensen
10	Nov. 13, 1958	- - - - - do - - - - - -	Clark
11	Dec. 11, 1958	- - - - - do - - - - - -	Clark
12	Jan. 15, 1959	- - - - - do - - - - - -	Jensen

T-79 CRUISE SCHEDULE

Cruise No.	Date	Purpose	Chief of Party
	1956		
1	May 25-27	Shake-down cruise to test suitability of T-79 as a fisheries research vessel, to test the fishing gear and hauling equipment and to tag haddock 18 miles southwest of Pollock Rip Lightship.	Clark
2	June 28-July 14	To tag fish in the Gulf of Maine.	Clark
3	August 22	To collect spawning butterfish southeast of No Man's.	Colton
4	August 29	To test trawling gear on the Middle Ground.	Colton
5	August 31	To collect spawning butterfish in an area 10 miles south of No Man's.	Colton
6	Sept. 12-14	1. To sample species composition of fishes on various grounds. 2. To determine diurnal periodicity of feeding habits of the commoner species of fish. 3. To determine the abundance of and the species of the various common bottom organisms, and 4. To tag skates and some other species of fish if they are sufficiently abundant on the grounds fished. Area - Southern New England fishing grounds.	Edwards
7	Oct. 5	To test underwater television equipment under tow in Falmouth Harbor.	Livingstone

Cruise No.	Date	Purpose	Chief of Party
8	Oct. 10-12	To make a hydrographic transect of the "Deep Hole" and to conduct studies into the feeding habits of local fish.	Edwards
9	Oct. 16	To test underwater TV equipment and handling procedures off Naushon Island.	Livingstone
	1957		
10	Feb. 14	To test otter trawl gear and to tag yellowtail flounders about 12 miles south of Cox Ledge in 30 fathoms.	Lux
11	Feb. 25	To tag yellowtail flounders south of No Man's to south of Block Island.	Lux
12	March 12	Investigate fish stocks in Buzzards Bay for the purpose of tagging.	Edwards
13	Mar. 12-14	Hydrographic transect south of Martha's Vineyard and Block Island.	Edwards
14	March 22	Looking for stocks of fish in Buzzards Bay.	Edwards
15	March 26	Test and use underwater camera in Buzzards Bay.	Posgay
16	Sept. 16-20	To tag silver hake two miles west of Race Point, Stellwegen Bank, and Cape Cod Bay.	Fritz
17	Oct. 15-17	To find concentrations of scup for tagging, to test fishing gear; to do some red hake biology in the Block Island area.	Edwards
18	Oct. 30	To sample flounders and industrial species off Nauset Beach in 25-30 fathoms.	Lux
19	Nov. 14-27	To tag haddock and to collect young-of-the-year haddock off Gloucester and Mt. Desert Island, Maine.	Dietsch

Cruise No.	Date	Purpose	Chief of Party
	1958		
20	Jan. 21	To sample yellowtail flounder 25-30 miles southwest of No Man's Land.	Lux
21	Jan. 28-31	Calibration of multiplane kite otter and high-speed plankton sampler off Provincetown and Murray Basin.	Colton
22	Aug. 11	To return vessel T-79 to Army authorities at Army Transportation Depot, Charleston, South Carolina. In charge: Captain Samuel Vincent	

Cruise Records

for

COMMERCIAL CHARTERS AND T-79

Vessel	Sailing Order	Supple-ment	Cruise Report	Trawl Cards	Logs	BT Cards
We Three	O	X	X	O	O	O
Michigan 1	Original Rough logs		X	X	O	O
Michigan 2	Original Rough logs		X	X	O	O
U.S. FW Launch	O	O	X	X	O	O
Caryn	O	O	X	O	O	O
Wisconsin	Original Rough logs		X	X	O	O
Cap'n Bill II	O	O	X	O	O	O
Priscilla V 1						
Priscilla V 2	Age and Growth of the Redfish in the Gulf of Maine					
Priscilla V 3	Fishery Bulletin 156					
Priscilla V 4						
Priscilla V 5	Original Rough logs		O	O	O	O
Priscilla V 6						
Huckleberry Finn	O	O	X	O	O	O
William Cheesebrough						
Harengus	O	O	X	O	O	O
Whaling City 1	O	O	X	O	O	O
Whaling City 2	O	O	X	O	O	O
Jacquelyn 1	O	O	X	X	O	X
Jacquelyn 2	O	O	X	X	O	X
Jacquelyn 3	O	O	X	X	O	X
Jacquelyn 4	O	O	X	X	O	X
Jacquelyn 5	O	O	X	X	O	X
Dartmouth	X	O	X	O	O	O
Whaling City 3	Z	X	X	O	O	O
Whaling City 4	X	X	X	O	O	X

Silver Mink and Shirley and Roland Cruises						BT Records
1	O	O	X	X	O	X
2	O	O	X	X	O	X
3	O	O	X	X	O	X
4	O	O	X	X	O	X
5	O	O	X	X	O	X
6	O	O	X	X	O	X
7	O	O	X	X	O	X
8	O	O	X	X	O	X
9	O	O	X	X	O	X
10	O	O	X	X	O	X
11	O	O	X	X	O	X
12	O	O	X	X	O	X

T-79 Cruises

1	O	O	X	O	O	X
2	X	O	X	O	O	O

Cruise Records (Continued)

for

COMMERCIAL CHARTERS AND T-79

Vessel	Sailing Order	Supple-ment	Cruise Report	Trawl Cards	Logs	BT Cards
T-79 Cruises						
3	X	O	X	O	O	O
4	X	O	O	O	O	O
5	X	O	X	O	O	O
6	X	X	X	O	O	O
7	X	O	X	O	O	O
8	X	X	X	X	O	X
9	X	O	X	X	O	O
10	X	O	X	O	O	X
11	X	O	X	O	O	X
12	X	O	X	O	O	X
13	X	O	X	O	O	X
14	X	O	X	O	O	O
15	X	O	X	O	O	O
16	X	O	X	O	O	O
17	O	O	X	X	O	X
18	X	O	X	X	O	O
19	X	X	X	O	O	O
20	X	O	X	O	O	X
21	X	X	X	O	O	O
22	X	O	O	O	O	O

R.V. ALBATROSS IV

The R. V. Albatross IV arrived in Woods Hole November 28, 1962, on her maiden voyage from the Southern Shipbuilding Corporation at Slidell, Louisiana. From that time, until her first official cruise, several training cruises were made to familiarize the officers, crew, and scientists with the vessel. The "Kort type" nozzle was modified with the addition of fins, and various types of gear were either added or altered to insure a smooth working operation.

On May 9, 1963, the Albatross IV was commissioned at Woods Hole, Massachusetts. Secretary of the Interior Stewart Udall and other distinguished guests were present at the ceremonies.

May 13, 1963, the Albatross IV sailed on her first official cruise to collect quantitative samples of the sea scallop population on Georges Bank.

At the present time the stability, ease of handling all types of gear, and other facilities of the Albatross IV would be hard to exceed by any vessel of similar size.

FURTHER CONSIDERATION OF GROUNDFISH MINIMUM MESH SIZE.

H. W. Graham

Introduction.

In ICNAF there is considerable interest in extending mesh regulation where feasable to all species of groundfish in all Subareas. At the present time there are either regulations or Commission recommendations for regulation for 4-1/2 inch minimum mesh size for all species of groundfish in Subareas 1 and 2; for all species of groundfish in Subarea 3 except for redfish in divisions 3N, 3O, and 3P; for cod, haddock, and flounders in Subarea 4; and for cod and haddock in Subarea 5.

The present report discusses the possible effect of extending mesh regulation to species other than cod and haddock in Subarea 5. The relative importance, in terms of pounds landed, of the various species taken in the Subarea is presented in Table 1. It will be noted that industrial species rank high in this list even though the industrial plants were running at a much lower level in 1960 than in previous years. We have no analysis of the species composition of the industrial landings for that year, but the data for 1958, when the plants were running at greater capacity, will serve to indicate the relative importance of the different species in the New England industrial trawl fishery. These are presented in Table 2.

Sizes of mesh now in use.

The Boston haddock fleet composed of large trawlers regularly uses 4-1/2 inch mesh under the international mesh regulation. Smaller vessels out of Boston and other ports may engage primarily in haddock fishing on some trips and for redfish or whiting or industrial species on other trips. In this case they may register as haddock boats and use 4-1/2 inch mesh for the haddock trips; then cancel their certificates and use smaller mesh nets to engage in other fisheries. In the case of whiting fishing they are likely to catch haddock and cod as well as whiting as these species are frequently found together. Under present regulations a vessel fishing with small mesh may land 5,000 pounds or 10 percent of its trip in cod or haddock or, if it is appropriately registered, land any amount of haddock per trip provided its total landings for the year do not exceed 10 percent haddock and 10 percent cod.

Large mesh is also used on vessels directing their fishing for yellowtail and other flounders, in this case voluntarily. However, here too we have a mixed fish problem. Some vessels engage variously in fishing for yellowtail and for smaller species such as scup, butterfish, and whiting which are used for human food, and for whiting and other smaller species such as red hake which are used for industrial purposes. These vessels usually carry small mesh nets in order to retain these smaller species.

Table 1.--Landings of the more important species of groundfish in United States from Subarea 5 in a typical year (1962).

	000's of pounds (Round, fresh)
Haddock	119,957
Silver Hake	97,448
Yellowtail	56,301
Industrial	53,702
Cod	41,063
Redfish	27,648
Winter Flounder	15,536
Pollock	12,236
Scup	8,659
Red Hake	5,448
White Hake	5,179
American Plaice	4,248
Fluke	3,339
Witch	2,152

Table 2.--Species composition of industrial landings in New England in 1958.

	000's of pounds
Red Hake	62,522
Silver Hake	21,785
Big Skate	8,599
Eel Pout	7,626
Little Skate	7,198
Angler	6,638
Spiny Dogfish	5,813
Long Horn Sculpin	1,838
Sea Robin	1,766
Butter Fish	1,747
Blueback	1,528
Alewife	1,201
Four-Spot Flounder	1,073
Other	7,484
Total	136,819

From Edwards and Lawday, 1960. Special Scientific Report No. 346.

Extend the 4-1/2 inch mesh regulation?

One may say at the start that extending the 4-1/2 inch mesh regulation to all species of groundfish in Subarea 5 cannot be seriously considered. This size is too large to provide maximum sustained yield for such important species as redfish and whiting, and would seriously reduce the catch. Although it would have little effect on vessels fishing specifically for yellowtail flounder, it could not be applied to the yellowtail flounder fishery without causing serious complications with vessels that fish variously for yellowtail and other species, a problem already encountered in the haddock regulation.

Apply a smaller minimum mesh size?

Although extension of the 4-1/2 inch minimum mesh regulation to other species cannot be considered for Subarea 5, it is worthwhile looking into the possible effects of applying some smaller minimum mesh size for the Subarea for species other than cod and haddock. In studying this problem it was found that a minimum mesh size of 3-1/2 inches (double manila) for species other than cod and haddock has considerable merit. It would provide a cleaner catch of all species now taken with smaller meshes, reduce the quantity of undesirably small fish caught but not now landed for the food market, reduce the discard of haddock by the mixed groundfish fishery, and would probably increase the long term yield of whiting.

Silver Hake

This species is marketed for human food, animal food, and for industrial purposes. It is fished with small mesh of different sizes, but mostly below three inches. If we assume present average mesh size to be 2-1/2 inches (double manila); increases to 3, 3-1/2, or 4 inches would have long term benefits after some initial loss. In Table 3 these benefits and losses are tabulated for the total catch of whiting. Since the food fishery is not interested in the smaller sizes of whiting these estimates of initial losses would not apply. They would apply, however, to the industrial fishery. The immediate loss to the landings of silver hake for food would be 8 percent for a 3-1/2 inch (double manila). The long term gains would not be achieved for several years. It would take 8 to 10 years to compensate for the immediate losses.

Figures 1b, 3a, and 3b compare the size compositions of present landings of silver hake with size composition to be expected if a 3-1/2 inch (double manila) net were used.

Table 3.--Effect of increasing mesh size in silver hake nets.

Change in mesh size inches from 2-1/2 to	Percent change in catch Immediate	Long term
3 inches	- 4	+ 4
3-1/2 inches	-22	+13
4 inches	-47	+17

Red Hake.

This species is taken almost entirely for industrial purposes and comprises some 45 percent of the trawl fish industrial catch in New England when this industry is active (Table 2).

Figure 2a. shows the average size frequency of the catch compared with the expected frequency with a 3-1/2 inch mesh. The initial loss would be about 13 percent by weight. Long term benefits are not known.

Redfish.

This fishery currently uses nets with mesh size of about 2-3/4 inches (double manila). Our own studies, and that of ICNAF's Assessment Group have not furnished useable estimates of the effects of increasing mesh size on yields of this species. Figure 1a. presents the length-frequency curve of landings for the present fleet compared with length frequency to be expected under 3-1/2 inch regulation. There is very little discarding and the 3-1/2 inch double manila would apparently decrease the immediate landings by about 7 percent by weight. Note that the losses would be in the sizes considered undesirable by the food market. There is some evidence that the large commercial sized catches would reduce considerably the calculated escape rate in which case the initial losses would be less than 7 percent. Long term benefits cannot be estimated at the present time.

Flounders.

Figure 4 presents length frequencies of the landings for the four larger species of flounder taken in Subarea 5. The 50% selection point of the 3-1/2 inch mesh for these species is considerably below the smallest sizes landed in 1957-59. The inclusion of these species under a 3-1/2 minimum mesh regulation would have little immediate effect on landings. In some years when flounders are unusually abundant and there is a glut on the market, large quantities of small fish are said to be caught and discarded at sea even by vessels using large mesh nets (4-1/2 to 5 inches). The extent of this discard and the viability of flounder under these conditions are unknown. In any case the institution of a 3-1/2 inch mesh regulation is not likely to change either the immediate or long term yield for these four species.

The situation is different as regards one of the smaller species of flounder, the dab. Figure 2b. compares the size distribution of dab caught in 1956-59 with that to be expected if 3-1/2 inch (double manila) mesh were sued. In the case of this species the catch would suffer a 21 percent immediate loss. The 3-1/2 inch mesh would, however, retain all fish of a size desirable for food. Whether any long term benefits would accrue is not known. Dab is, of course, one of the minor species in the total New England landings. About 1.8 million pounds were landed in 1960.

Haddock.

As mentioned above there is some quantity of haddock taken by vessels using small mesh nets. Some of these vessels are seeking haddock while others are catching them incidentally to the catch of other species such as whiting. In any case, they land under some exemption to the haddock regulation. The disposition of these haddock catches depends upon whether or not the industrial plants are operating and accepting trawl fish. The haddock catch is culled on board. The larger sizes are sold to the food market and the smaller ones are either sold as trash or, if the trash plants are not operating, discarded at sea. Discarded haddock are not viable and are lost to the fishery.

The magnitude of the catch of undersized haddock (i.e., haddock below the sizes taken by the regulation 4-1/2 inch mesh) is difficult to determine as obtaining data on this involves sampling the discard of the small mesh fleet which is composed of smaller vessels and sampling the industrial landings. During the period 1957-59 when the industrial fishery was operating actively in New England, the average landings of haddock for industrial purpose was 3 million pounds per year. These were all undersized fish as defined above, the food market size having been culled out.

Although the industrial fishery is not now operating fully, there is heavy fishing in areas where small haddock abound. In 1962 about 25 percent of the haddock landed in the U.S. (representing about 26 million pounds) was landed under some exemption and, therefore, was presumably caught with small mesh (Table 3). The vessels concerned were in general the same fleets that participated in the industrial fisheries in 1957-59, and generally fish the same grounds. Thus, it is only reasonable to suppose that they are taking undersized haddock as well as larger sizes. Since the food market does not normally accept haddock under 38 cm., the 50 percent selection size of the 4-1/2 inch mesh, the undersized haddock apparently are now being discarded at sea.

No mesh size under 4-1/2 inches will completely eliminate this discard, but a 3-1/2 inch mesh would materially reduce it (Table 4). General use of a 3-1/2 inch mesh by these vessels would reduce the catch of undersized haddock by 80 percent. This would serve to increase the sustained yield of haddock from Subarea 5.

Table 4.--Analysis of haddock landings by type of certificate for Subarea 5 and for all Subareas, 1962. 1/

	Subarea 5		All Subareas	
	Haddock Landed 000's pounds (gutted weight)	% Haddock	Haddock Landed 000's pounds (gutted weight)	% Haddock
Registered Cod and Haddock Vessels	78,740	75.0	88,019	74.9
Non-Registered Vessels	26,261	25.0	29,440	25.1
Totals	105,001	100	117,459	100
Non-Registered Vessels Breakdown				
10% Annual Exempted	3,834	3.7	4,088	3.5
Trip Exempted	19,724	18.7	22,649	19.3
Other gear	2,703	2.6	2,703	2.3
Totals	26,261	25.0	29,440	25.1

1/--On a trip basis.

Table 5. Sizes of haddock landed by Gloucester industrial fishery, 1957-59[1/]

Length (cm.)	Ipswich Bay number	Stellwagen Bay number	Nausets number	Total Number	Total Percent
> 9			4	4	-
9			9	9	1
12	1	5	9	15	1
15	4	30	5	39	3
18	16	29	23	68	5
21	35	28	85	148	12
24	33	41	117	191	15
27	35	84	141	260	21
30	19	142	103	264	21
B					B
33	27	78	65	170	14
36	17	12	27	56	4
A					A
39	10	3	7	20	2
42	3	1	--	4	-
45		1	--	1	-
48			1	1	-
51			1	1	-
Total				1, 251	100

1/ From Edwards and Skerry, 1961.

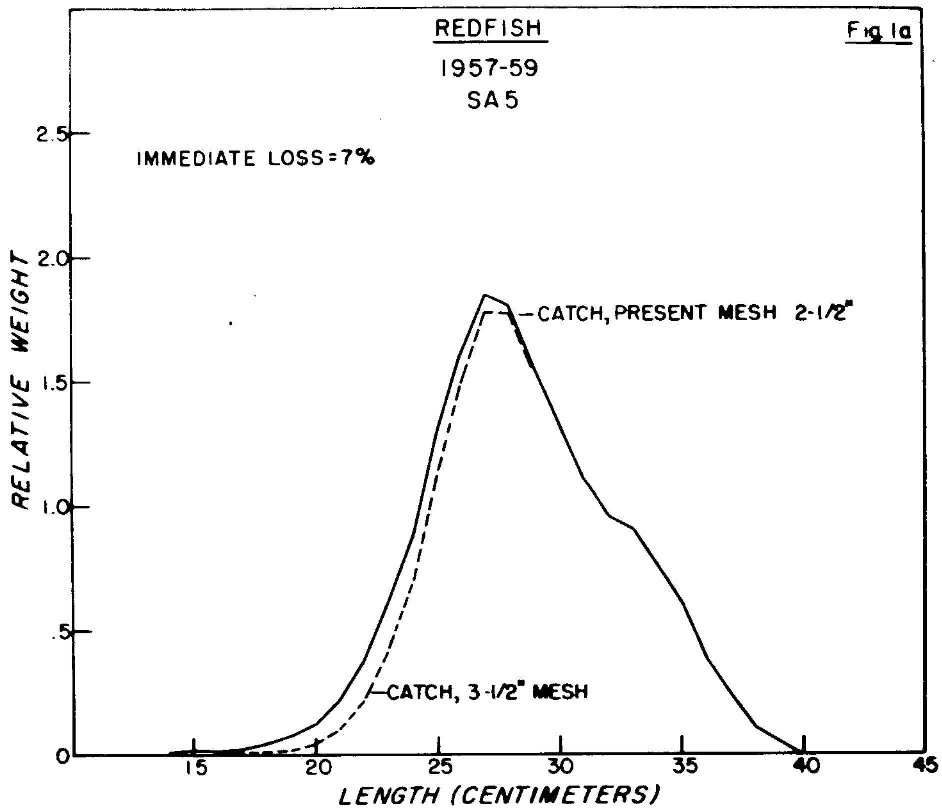
A-A = 50% selection point of 4-1/2 inch mesh.

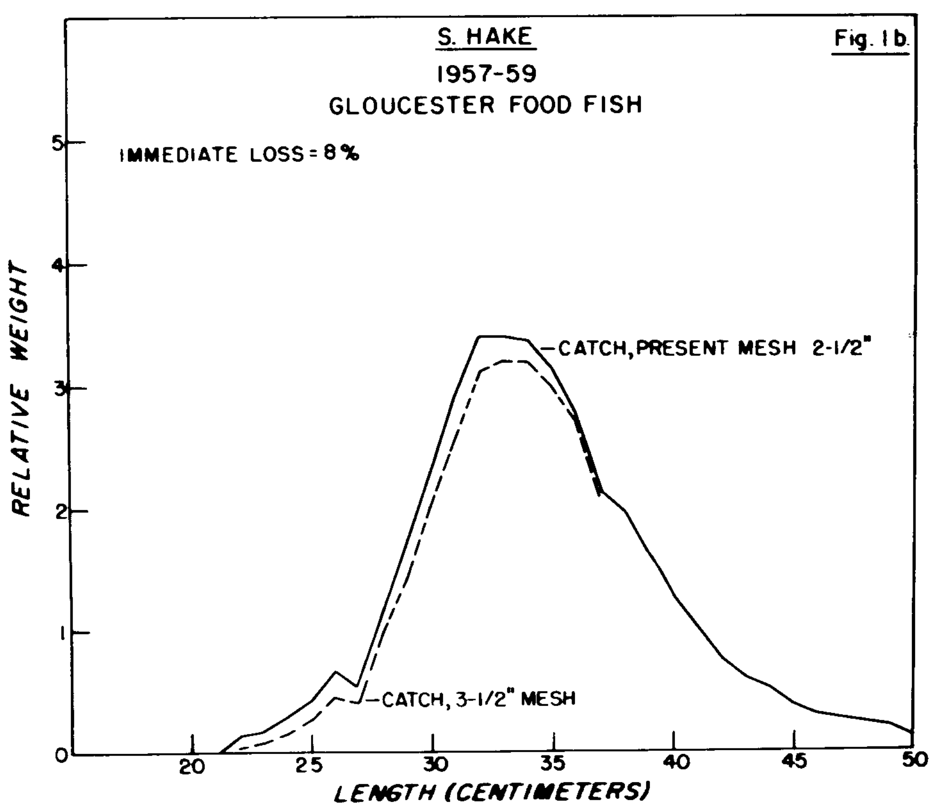
B-B = 50% selection point of 3-1/2 inch mesh.

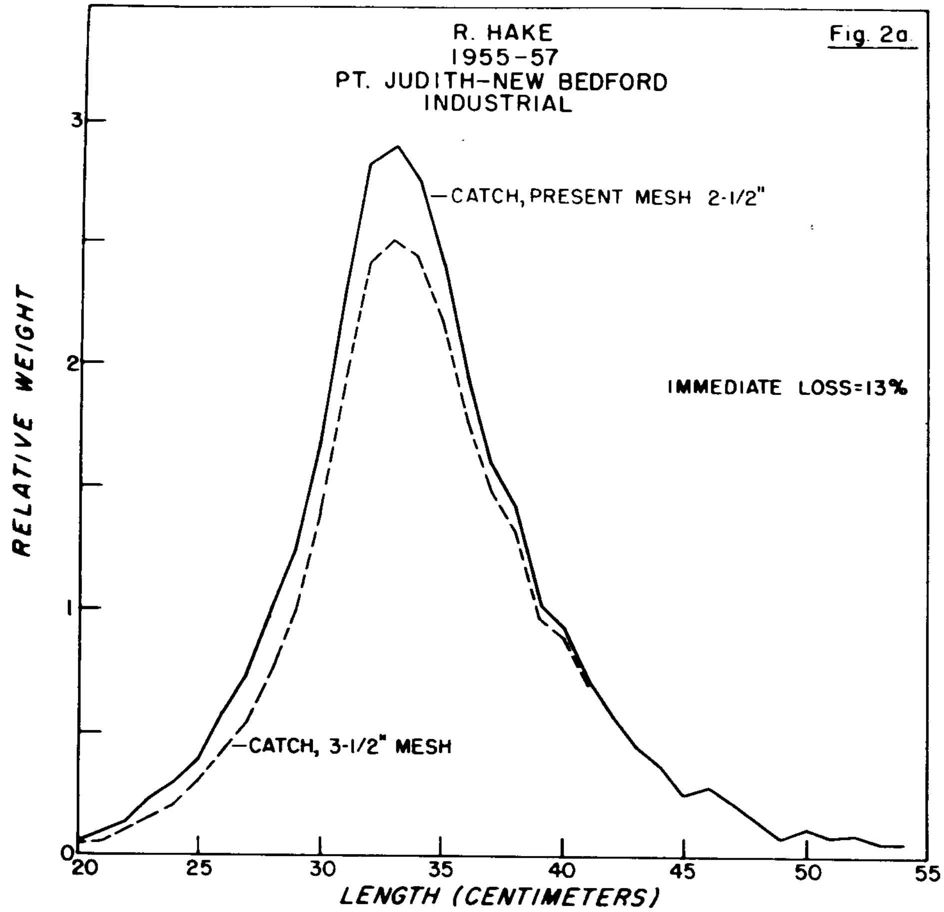
Conclusions.

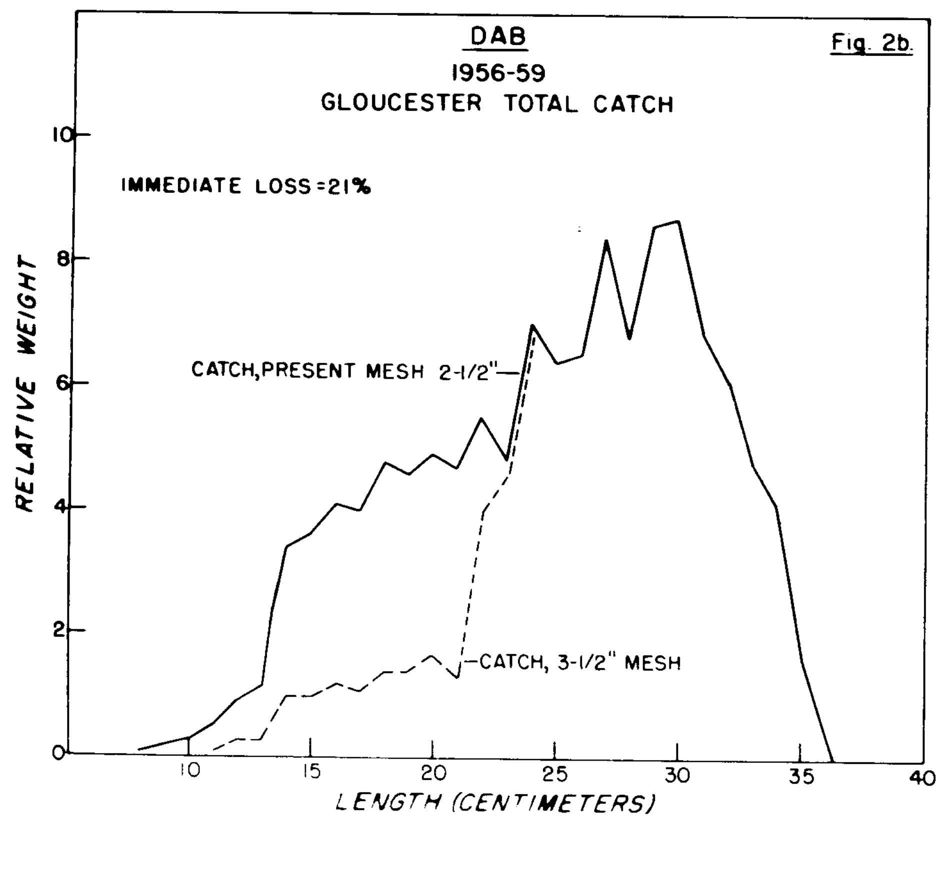
1. Extension of the 4-1/2 inch minimum mesh size regulation in Subarea 5 to all species other than cod and haddock is not desirable as it cannot be shown to be beneficial from a conservation standpoint and would be injurious to a number of fisheries.

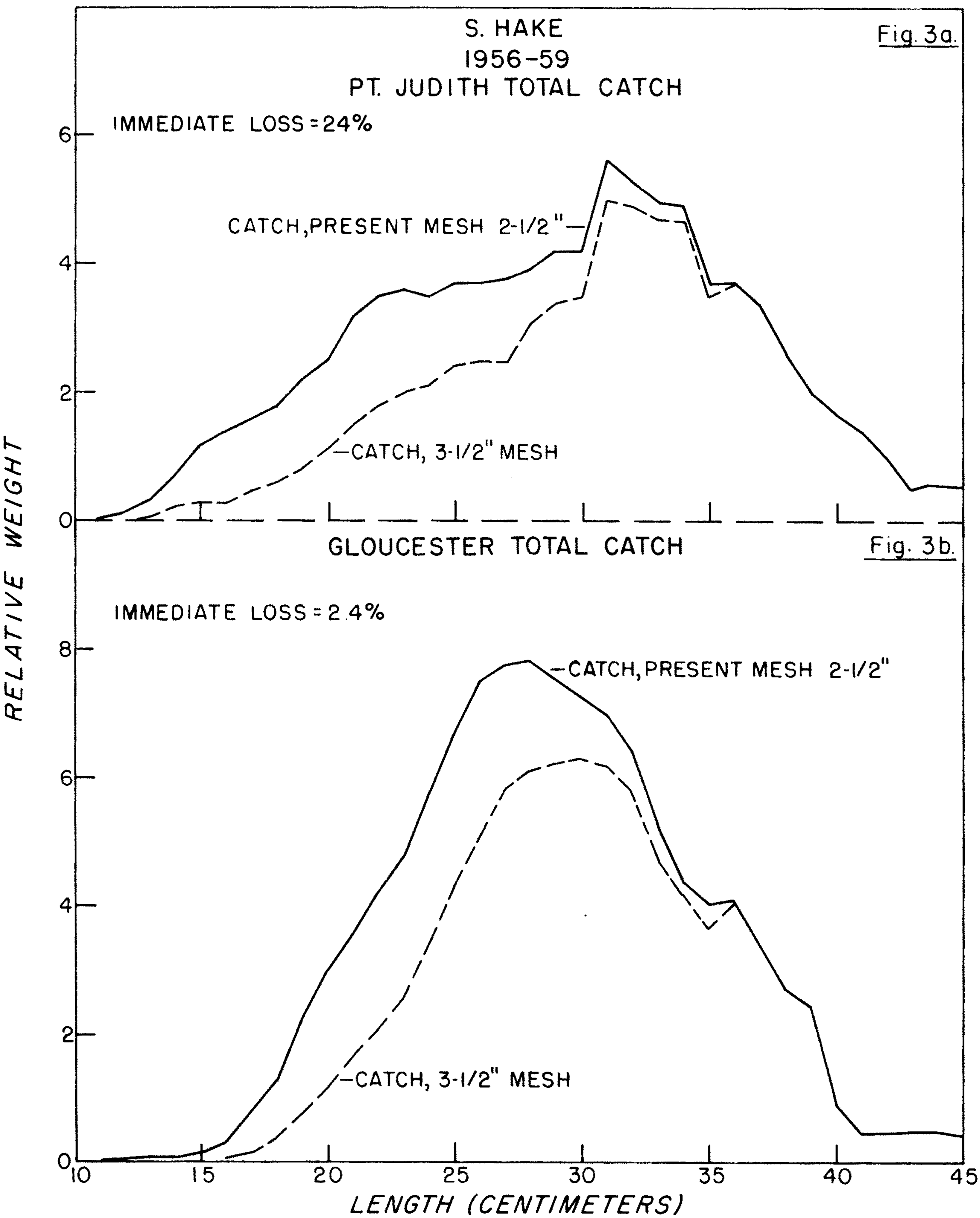
2. Adoption of a minimum mesh size of 3-1/2 inches (double manila) for species other than cod and haddock is of some merit and is worth considering. It would materially reduce the destruction of undersized haddock; produce cleaner catches of all species by reducing the debris in the net; reduce the quantity of undesirable sizes of many species; and increase the long term yield of whiting. On the negative side it would immediately reduce the amounts landed of red hake (8 percent)and silver hake (21 percent) and possibly some other industrial species unless some exemptions were worked out for these.

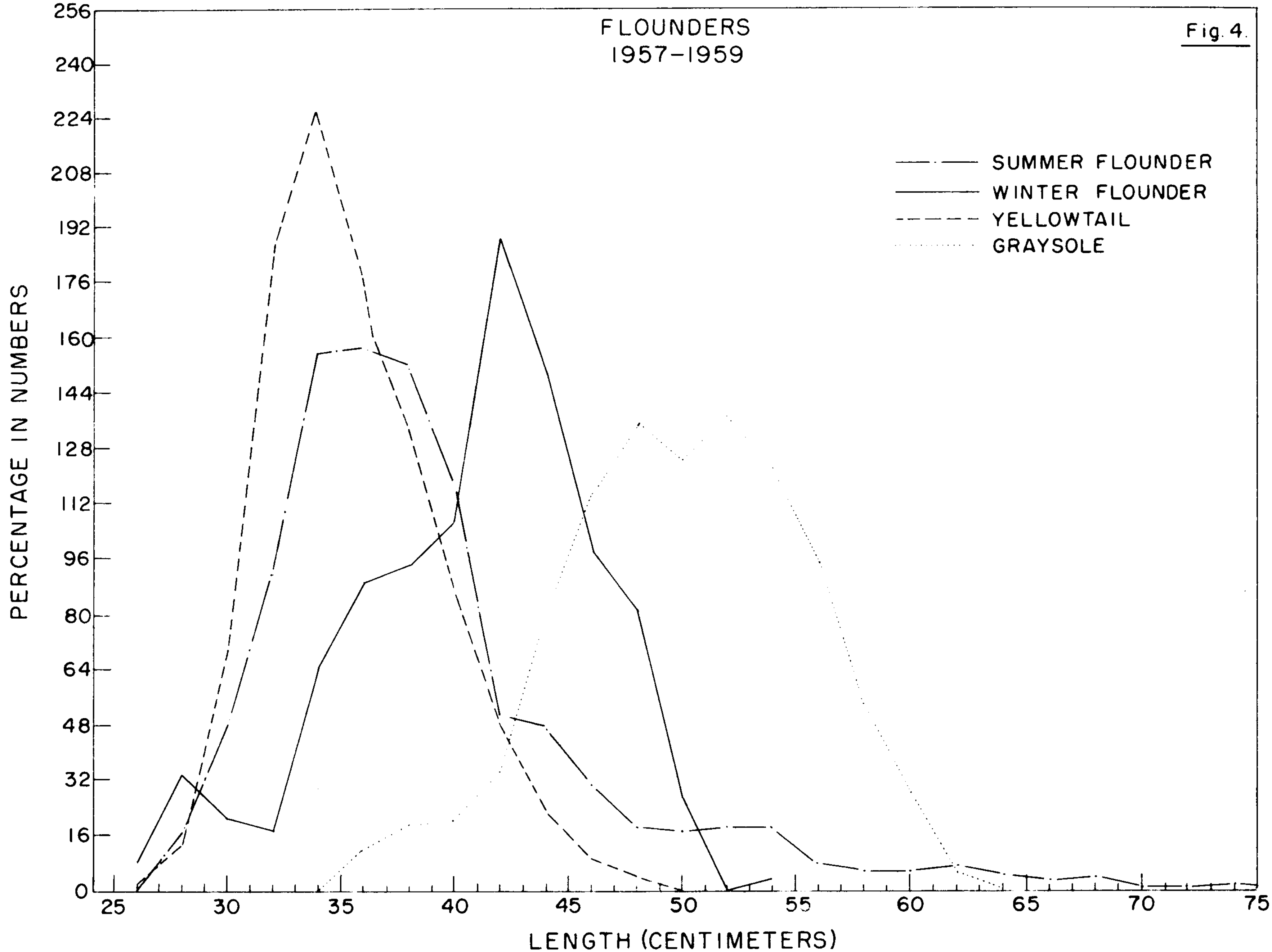

REDFISH
1957-59
SA 5
Fig. 1a
IMMEDIATE LOSS = 7%
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
RELATIVE WEIGHT
LENGTH (CENTIMETERS)
0
.5
1.0
1.5
2.0
2.5
15
20
25
30
35
40
45


S. HAKE
1957-59
GLOUCESTER FOOD FISH
Fig. 1b.
IMMEDIATE LOSS = 8%
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
RELATIVE WEIGHT
LENGTH (CENTIMETERS)
0
1
2
3
4
5
20
25
30
35
40
45
50


R. HAKE
1955-57
PT. JUDITH-NEW BEDFORD
INDUSTRIAL
Fig. 2a.
CATCH, PRESENT MESH 2-1/2"
IMMEDIATE LOSS=13%
CATCH, 3-1/2" MESH
RELATIVE WEIGHT
LENGTH (CENTIMETERS)
0
1
2
3
20
25
30
35
40
45
50
55


DAB
1956-59
GLOUCESTER TOTAL CATCH
Fig. 2b.
IMMEDIATE LOSS=21%
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
RELATIVE WEIGHT
LENGTH (CENTIMETERS)
0
2
4
6
8
10
10
15
20
25
30
35
40


S. HAKE
1956-59
PT. JUDITH TOTAL CATCH
Fig. 3a.
IMMEDIATE LOSS = 24%
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
GLOUCESTER TOTAL CATCH
Fig. 3b.
IMMEDIATE LOSS = 2.4%
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
RELATIVE WEIGHT
LENGTH (CENTIMETERS)
0
2
4
6
8
10
15
20
25
30
35
40
45


FLOUNDERS
1957-1959
Fig. 4.
SUMMER FLOUNDER
WINTER FLOUNDER
YELLOWTAIL
GRAYSOLE
PERCENTAGE IN NUMBERS
0
16
32
48
64
80
96
112
128
144
160
176
192
208
224
240
256
25
30
35
40
45
50
55
60
65
70
75
LENGTH (CENTIMETERS)